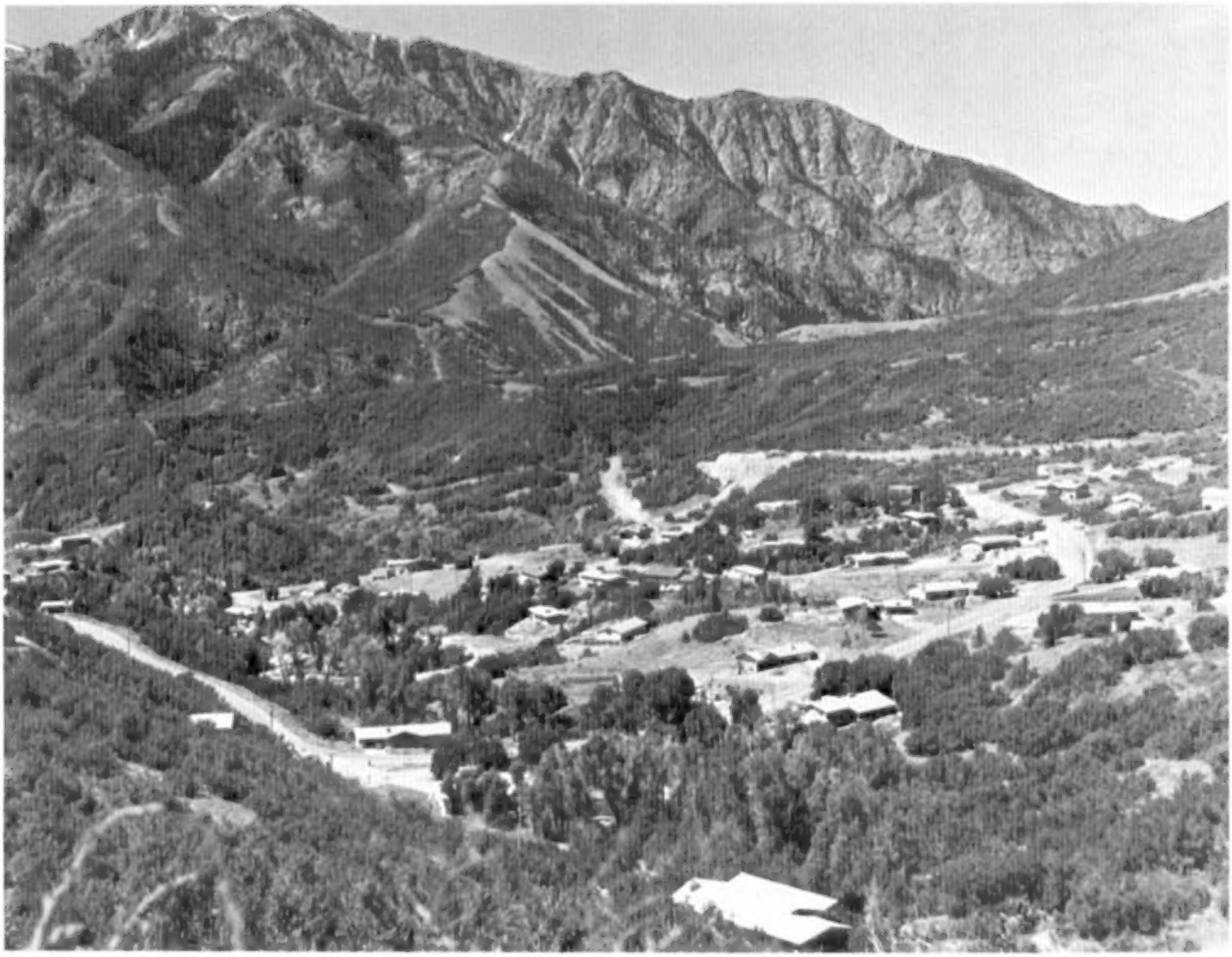
Morgan Area, Utah
Morgan County and Eastern Part of Weber County

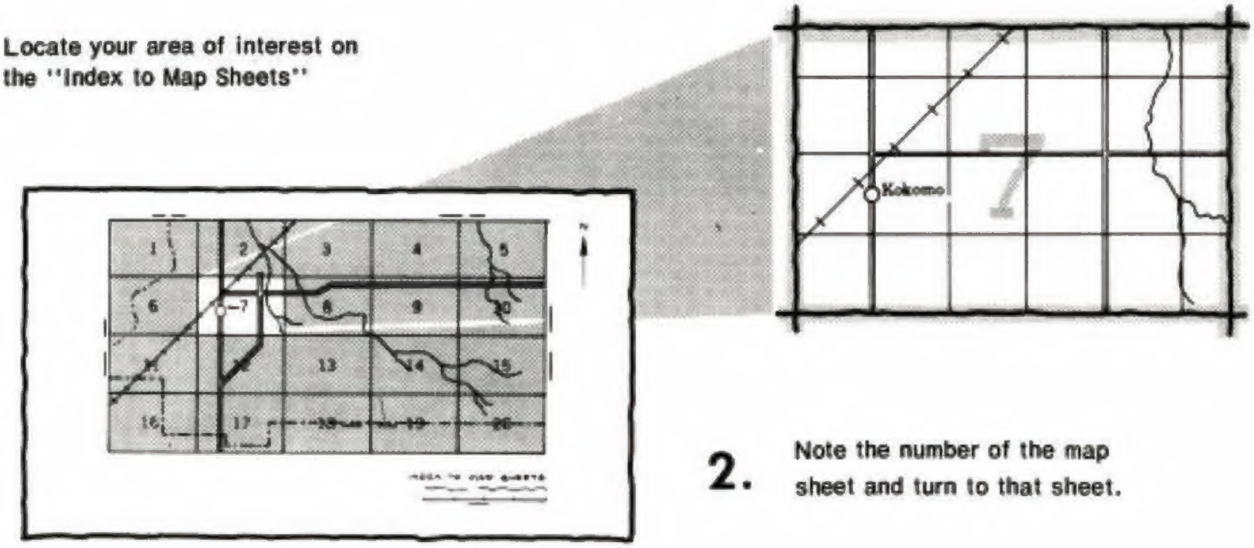


United States Department of Agriculture
Soil Conservation Service and
Forest Service

In cooperation with
Utah Agricultural Experiment Station

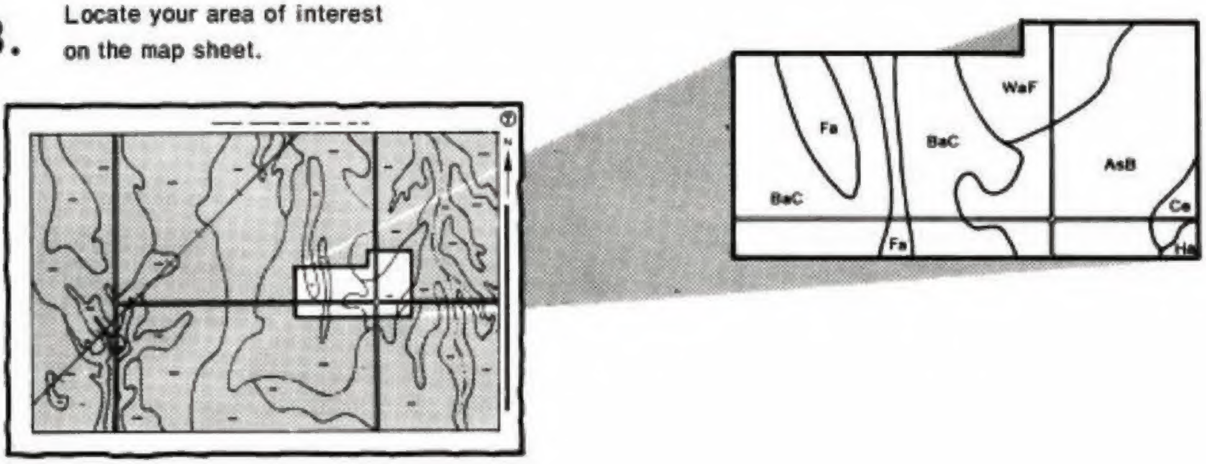
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

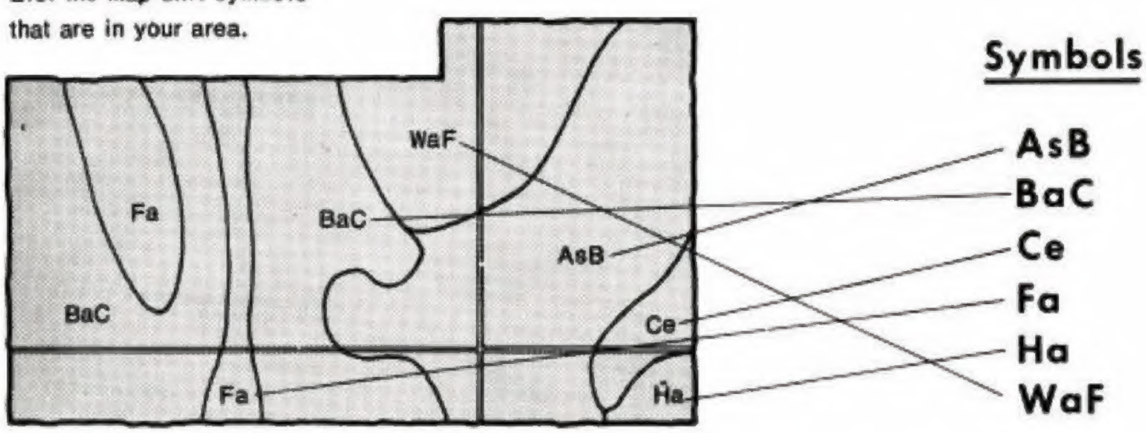


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

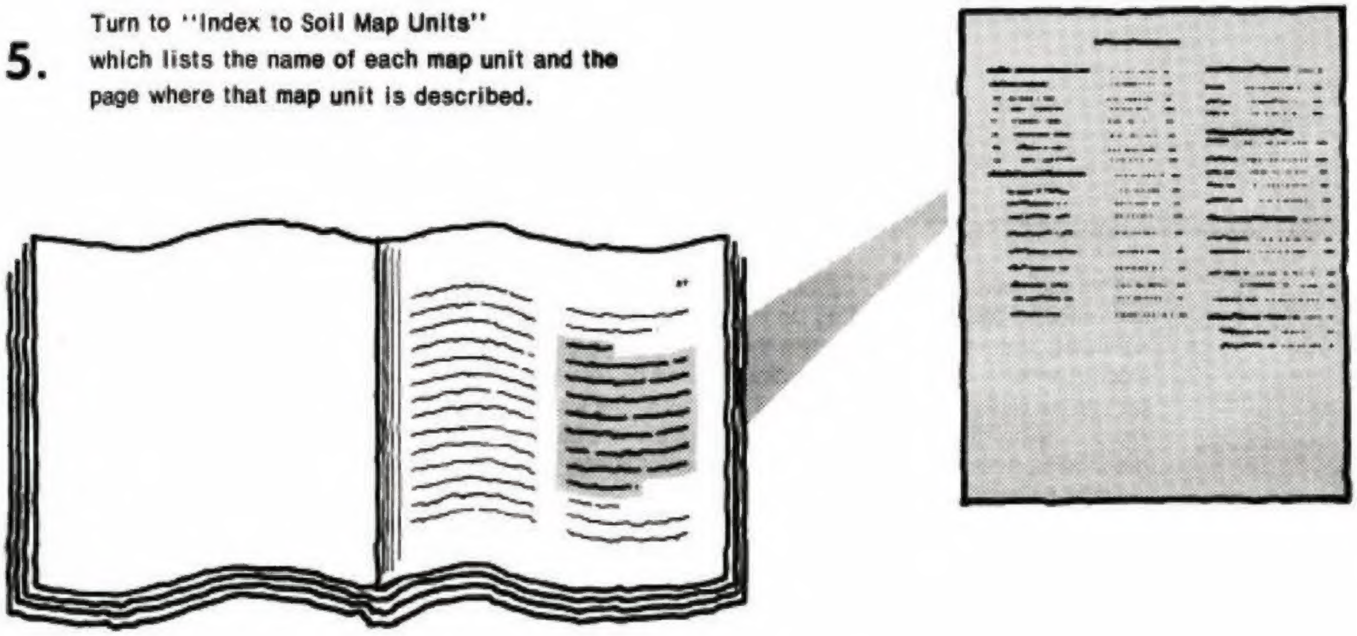


4. List the map unit symbols that are in your area.

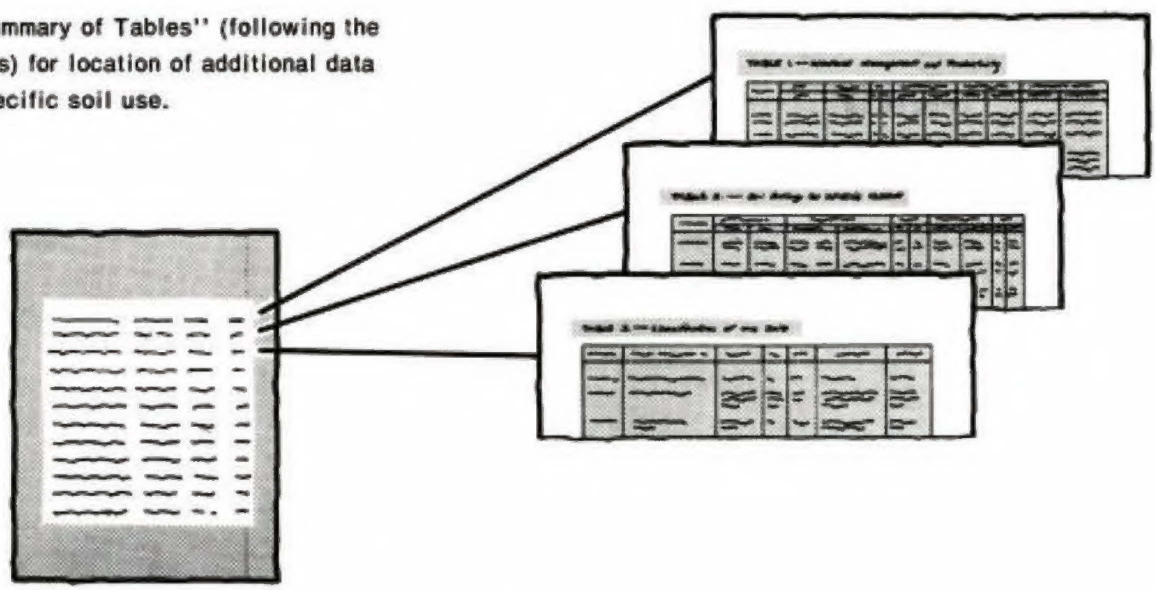


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Utah Agricultural Experiment Station. It is part of the technical assistance furnished to the Ogden Valley and Morgan Soil Conservation Districts.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Subdivision development in this survey area. Houses are built on Manila loam. The foot slopes beyond the houses are Hawkins silty clay, and the mountains in the background are Nagitsy-Rock outcrop complex.

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Issued May 1980

Index to soil map units

Summary of Tables

Foreword

The Soil Survey of Morgan Area, Utah contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

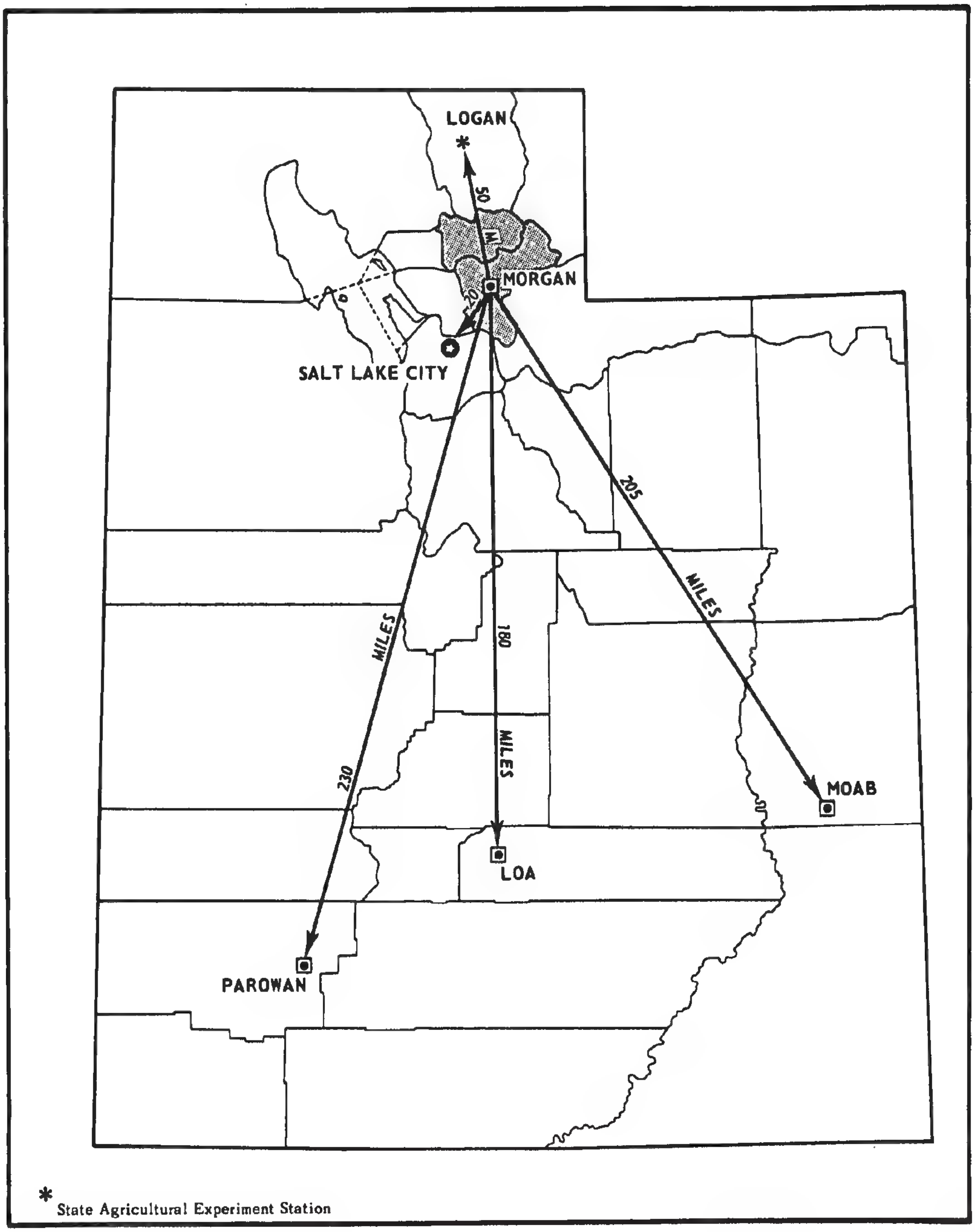
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

George McMillan
State Conservationist
Soil Conservation Service



Location of Morgan Area in Utah.

SOIL SURVEY OF MORGAN AREA, UTAH
MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY

By James A. Carley, Earl H. Jensen, Ludene B. Campbell, Marvin Barney, Robert H. Fish, and Raymond S. Chadwick, Soil Conservation Service, and Paul Winkelaar, Forest Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with the Utah Agricultural Experiment Station

MORGAN AREA is in the northern part of Utah. The survey area consists of Morgan County and the eastern part of Weber County, totaling 605,823 acres or about 946 square miles. Of this total 390,400 acres, or 610 square miles, is in Morgan County and 215,423 acres, or 346 square miles, is in Weber County.

Morgan, the county seat of Morgan County, has a population of about 1,600. Morgan County includes lands of the Lost Creek drainage, Cottonwood Creek drainage, and the lower part of the East Canyon Creek drainage.

The eastern part of Weber County, commonly referred to as Ogden Valley, has a population of 2,575. Weber County lands include those in the Ogden River drainage east of Ogden, Utah. Ogden, the county seat of Weber County, is located out of this soil survey area.

The survey area generally includes the valleys and mountains on the east side of the Wasatch Mountains in Weber County. The South Fork, Middle Fork, and North Fork of the Ogden River drain into the Ogden Valley, in eastern Weber County, along with numerous other small streams that head in the surrounding mountains. The Ogden River is the major drainage for these streams. It leaves Ogden Valley through Ogden Canyon and flows into the Weber River west of Ogden.

The Weber River enters Morgan County from the east near Devils Slide. It flows west through the city of Morgan and Morgan Valley into Weber Canyon through Weber County into the Great Salt Lake. It is joined by the Ogden River west of Ogden. Lost Creek drains a large area in the northeastern part of Morgan County, and East Canyon Creek drains a large area in the southern part of Morgan County. These creeks, along with Cottonwood Creek, Deep Creek, and numerous other smaller streams that head in the mountains bordering Morgan Valley, join together to form the Weber River.

The lowest elevation in the Morgan Valley is about 4,800 feet. The highest elevation is about 9,800 feet. Most of the area in Morgan Valley is above 5,150 feet, the high level of prehistoric Lake Bonneville.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different

levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Major land uses considered are cultivated farm crops, specialty crops, woodland, urban uses, intensive recreation areas, and extensive recreation areas. Cultivated farm crops include those grown extensively by farmers in the survey area. Specialty crops include vegetables, fruits, and nursery crops grown on limited acreage and generally requiring intensive management. Woodland refers to land that is producing trees native to the area or introduced species. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, baseball diamonds, and similar areas that are subject to heavy foot traffic. Extensive recreation areas include areas for nature study and wilderness uses.

Map unit descriptions

The fourteen map units and the four groups of map units shown on the general soil map of Morgan Area are discussed in the following pages.

Poorly drained to well drained soils on valley bottoms, alluvial plains, low alluvial fans, and terraces

These soils are mostly loam, silt loam, silty clay loam, or stony loam. They formed in alluvium and lake sediments weathered mainly from sandstone, quartzite and limestone.

Elevation ranges from 4,800 to 5,800 feet. The soils are nearly level to very steep. The average annual precipitation is 18 to 22 inches. The mean annual temperature is 43 to 46 degrees F. The frost-free season is 90 to 105 days.

These soils are used mainly for irrigated crops and pasture and nonirrigated crops.

The two map units in this group make up about 6 percent of the survey area.

1. Utaba-Eastcan-Pringle

Very deep, well drained to poorly drained soils that formed in alluvium on valley bottoms, alluvial fans, alluvial plains, and stream terraces

This map unit is made up of nearly level, gently sloping, and strongly sloping soils on valley bottoms, alluvial fans, alluvial plains, and stream terraces. It occurs mainly in Ogden Valley in Weber County and Morgan Valley in Morgan County and occupies about 3 percent of the survey area.

The soils in this map unit formed in mixed alluvium from sandstone, quartzite, limestone or argillite, phyllite, and schist. The dominant vegetation is bunchgrasses, shrubs, and forbs. The mean annual temperature is about 45 degrees F, and the average annual precipitation is about 20 inches. The frost-free period is about 100 days. Elevation ranges from 4,800 to 5,800 feet.

Utaba, Eastcan, and Pringle soils each make up about 15 percent of the map unit. Brownlee and Crooked Creek soils make up about 10 percent each. Minor soils make up about 35 percent.

The Utaba, Eastcan, and Pringle soils occur on flood plains. The Brownlee soils occur on stream terraces. The Crooked Creek soils occur in valley bottoms.

The Utaba soils are very deep and well drained. They are cobbly loam in the upper part of the surface layer and gravelly sandy loam in the lower part. The underlying layer is very gravelly sand to a depth of 60 inches or more.

The Eastcan soils are very deep and moderately well drained. They are loam or silt loam in the surface layer. The underlying layer is silt loam to a depth of 60 inches or more.

The Pringle soils are very deep and somewhat poorly drained. They are a loam in the upper part of the surface layer and stratified silt loam and very fine sandy loam in

the lower part. The underlying layer is very gravelly sand to a depth of 60 inches or more.

The Brownlee soils are very deep and well drained. They are loam in the surface layer. The subsoil is light clay loam, and the substratum is loamy sand to a depth of 63 inches or more.

The Crooked Creek soils are very deep and poorly drained. They are silty clay loam in the surface layer. The underlying layer is silty clay or clay loam underlain by sandy loam to a depth of 60 inches or more.

Sunset, Steed, Redola, and Eastcan variant soils are the minor soils in this map unit.

This map unit is used mainly for irrigated crops or irrigated pasture. The Eastcan and Brownlee soils are well suited for irrigated alfalfa and small grain. The Utaba, Pringle, and Crooked Creek soils are well suited to irrigated pasture.

Generally, these soils are well suited for farming or urban development. On-site studies should be considered if industrial uses are planned. The Pringle and Crooked Creek soils have a seasonal high water table that limits their use for urban development. The Utaba, Eastcan, and Pringle soils are on flood plains and have a hazard of flooding. However, present regulatory reservoirs on the major streams have reduced the hazard of flooding. Brownlee soils are well suited for urban or recreational developments.

2. Manila-Stoda-Nebeker

Very deep, well drained soils that formed in mixed lake sediments and alluvium on lake terraces, stream terraces, and alluvial fans

This map unit is made up of nearly level to very steep soils on stream terraces, lake terraces, and alluvial fans. It is mainly on the edges of Morgan Valley in Morgan County and Ogden Valley in Weber County and occupies about 3 percent of the survey area.

The soils in this map unit formed mainly in alluvium or materials weathered from sandstone, quartzite, argillite, phyllite, schist, or lake sediments. The dominant vegetation is bunchgrasses, forbs, and shrubs. The mean annual air temperature is about 45 degrees F, and the average annual precipitation is about 20 inches. The frost-free period is about 100 days. Elevation ranges from about 4,850 to 5,800 feet.

Manila soils make up about 35 percent of this map unit, and Stoda, Nebeker, Lamondi, and Parleys soils make up about 10 percent each. Minor soils make up the remaining 25 percent.

The Manila soils are dominantly on high lake terraces. The Stoda soils are dominantly on the high lake terrace escarpments. The Nebeker soils are mainly on stream terraces and alluvial fans. Lamondi soils are on high alluvial fans, and Parleys soils are on lake terraces, stream terraces, and alluvial fans.

The Manila soils are very deep and well drained. They are loam in the upper part of the surface layer and clay loam in the lower part. The subsoil is clay or heavy clay loam to a depth of 60 inches or more.

The Stoda soils are very deep and well drained. They are loam in the surface layer. The underlying layer is loam, silt loam, or very fine sandy loam to a depth of 65 inches or more.

The Nebeker soils are very deep and well drained. They are clay loam in the surface layer. The subsoil is clay in the upper part and sandy clay loam or clay loam in the lower part to a depth of 69 inches or more.

The Lamondi soils are very deep and well drained. The surface layer is stony loam in the upper part and cobbly loam in the lower part. The subsoil is very cobbly loam or very gravelly loam to a depth of 60 inches or more.

Parleys soils are very deep and well drained. They have a loam surface layer. The subsoil is silty clay loam or clay loam, and the substratum is silty clay loam or loam to a depth of 66 inches or more.

Parlo, Trojan, Broadhead, Kahler and Eastcan variant soils are the minor soils in this map unit.

This map unit is used mainly for irrigated and nonirrigated crops. Some of the soils are used for range, water supply, and wildlife habitat. Recreational uses are mainly snowmobiling and hunting. Some areas of the soils are used for homesites.

The Nebeker, Manila, and Parleys soils have limited ability to support heavy loads; however, dwellings and roads can be designed to offset this soil feature. Manila and Parleys soils also have slow permeability, which has caused problems with the operation of septic tank absorption fields in some areas. The moderately steep and steep slopes of the Stoda soils limit their potential for urban or recreational developments. The scattered stones over the soil surface and the high content of rock fragments in the soil limit the Lamondi soils for urban or recreational developments.

Well drained soils on mountain foot slopes, foothills, lower mountainsides, and associated alluvial fans and terraces

These soils are mainly silty clay, loam, silt loam, cobbly loam, and stony loam. They formed in materials weathered from sandstone, quartzite, andesite, and limestone.

Elevation ranges from 5,100 to 7,600 feet. The soils are gently sloping to very steep. The average annual precipitation is 18 to 25 inches. The mean annual temperature is 42 to 44 degrees F, and the frost-free season is 65 to 95 days.

These soils are used for range, wildlife habitat, and water supply.

The two map units in this group make up about 16 percent of the survey area.

3. Hawkins-Ostler-Manila

Very deep or moderately deep, well drained soils on foothills, mountain foot slopes, alluvial fans, and mountainsides

This map unit is made up of strongly sloping to very steep soils on rolling hills, foothills, mountain foot slopes, mountainsides, and alluvial fans. It occurs mainly in the western portion of the survey area in Weber and Morgan Counties and occupies about 10 percent of the survey area.

The soils in this map unit formed in materials weathered mainly from tuffaceous sandstone, tuffaceous siltstone, sandstone, andesite, and some quartzite and limestone. The dominant natural vegetation is bunchgrasses, shrubs, forbs, and oakbrush. The mean annual temperature is about 43 degrees F, and the average annual precipitation is about 22 inches. The frost-free season is about 90 days. Elevation ranges from 5,100 to 7,600 feet.

Hawkins soils make up about 25 percent of the map unit, Ostler soils, 20 percent; Manila soils, 15 percent; and Bertag and Donner soils, about 10 percent each. Minor soils make up about 20 percent of the map unit.

The Hawkins, Ostler, and Bertag soils occur dominantly in the northern part of the map unit. Bertag soils also occur in the southern part of the map unit with the Donner soils. The Manila soils are scattered throughout the map unit.

The Hawkins soils are dominantly on rolling hills, foothills, and alluvial fans on all aspects. They occur mainly under bunchgrasses, shrubs, forbs, and Gambel oak. The Ostler soils are very steep; they occur on all aspects but are dominantly on north- and east-facing foothills under a cover of bunchgrasses, shrubs, and forbs. Bertag soils occur dominantly on north-facing mountainsides under a cover of bunchgrasses, shrubs, forbs, Gambel oak, and maple. Donner soils occur mainly on south-facing convex ridges, knolls, foothills, or mountainsides under a cover of bunchgrasses, forbs, and shrubs.

The Hawkins soils are very deep and well drained. They are silty clay in the surface layer. The upper part of the underlying layer is silty clay and the lower part is clay, clay loam, or loam to a depth of 74 inches or more. These soils have high shrink-swell potential. The surface layer is mixed with the underlying layer to a depth of about 38 inches.

The Ostler soils are very deep and well drained. They are loam in the surface layer. The subsoil is clay or clay loam in the upper part and sandy clay loam in the lower part. The substratum is heavy clay loam to a depth of 60 inches or more.

The Manila soils are very deep and well drained. They are loam in the upper part of the surface layer and clay loam in the lower part. The subsoil is clay or heavy clay loam to a depth of 60 inches or more.

The Bertag soils are very deep and well drained. They are silt loam in the surface layer. The subsoil is heavy silty clay loam to a depth of 60 inches or more.

The Donner soils are moderately deep and well drained. They are cobbly loam in the surface layer. The subsoil is clay loam or silty clay. Soft weathered tuffaceous sandstone is at a depth of 34 inches. The depth to bedrock ranges from 23 to 40 inches.

Causey, Choptie, Session, Collinston, Norcan, Morgala, Mondey, Richville, and Ant Flat soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. Some areas of Manila soils are used for nonirrigated crops. Recreational use is mainly hunting, but some of the flatter areas are used for snowmobiling. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable.

Generally the steep or very steep slopes, low strength, and susceptibility to slippage are the soil features that limit the use of these soils for urban or recreational developments. Most of the soils also have slow or moderately slow permeability, which may cause problems in some areas if the soils are used for septic tank filter fields.

4. Durfee-Yeates Hollow

Very deep or deep, well drained soils on alluvial fans, mountain foot slopes, and mountainsides

This map unit occurs mainly north of Ogden Valley in Weber County and north of Enterprise and south of East Canyon Reservoir in Morgan County. It occupies about 6 percent of the survey area.

The soils in this map unit formed in colluvium and materials weathered from sandstone and quartzite. The dominant native vegetation is bunchgrasses, shrubs, forbs, Gambel oak, and bigtooth maple. The mean annual temperature is about 43 degrees F, and the average annual precipitation is about 20 inches. The frost-free season is about 80 days. Elevation ranges from about 5,100 to 7,400 feet.

Durfee soils make up about 45 percent of the map unit; Yeates Hollow soils, about 40 percent; and minor soils, about 15 percent.

The Durfee soils occur dominantly on south- and west-facing, very steep mountainsides. The Yeates Hollow soils occur dominantly on moderately steep and steep rolling mountainsides, alluvial fans, and east-, south-, and west-facing, very steep mountainsides.

The Durfee soils are very deep and well drained. They are stony loam in the upper part of the surface layer and very gravelly loam in the lower part. The subsoil is very gravelly heavy clay loam in the upper part and very gravelly clay in the lower part to a depth of 60 inches or more.

Yeates Hollow soils are deep and well drained. They are very stony loam in the upper part of the surface layer and cobbly loam in the lower part. The subsoil is cobbly or very cobbly heavy clay loam over bedrock. Depth to bedrock ranges from 42 to 60 inches or more.

Lamondi, Smarts, Norcan, Morgala, Moweba, Toone and Manila soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. Recreational uses are mainly hunting and snowmobiling on the flatter areas. Some areas are

used for homesites, cabin sites, and recreational developments.

The moderately steep, steep, and very steep slopes, high amount of rock fragments, and high amount of clay are the main limiting soil features for urban or recreational developments. Problems may develop with septic tank filter fields because of the slow permeability of most of the soil.

Well drained and somewhat excessively drained soils on mountain ridges, mountainsides, canyon walls, and associated fans and terraces, and Rock outcrop

These soils are mainly loam, gravelly loam, cobbly loam, very cobbly loam, very stony loam, or stony silt loam. They formed in residuum, colluvium, and alluvium from limestone, quartzite, sandstone, and some shale. The Rock outcrop is mainly on very steep canyon walls.

Elevation ranges from 5,200 to 8,500 feet. The soils are gently sloping to very steep. The average annual precipitation is 18 to 30 inches. The mean annual temperature is 40 to 45 degrees F, and the frost-free season is 60 to 90 days.

The five map units in this group make up about 37 percent of the survey area.

5. Agassiz-Foxol-Rock outcrop

Shallow, somewhat excessively drained soils on mountainsides and canyon walls, and Rock outcrop

This map unit is made up of very steep soils on mountainsides and canyon walls. It occurs mainly north and east of Ogden Valley in Weber County and north and east of Morgan in Morgan County and occupies about 5 percent of the survey area.

The soils in this map unit formed in materials weathered from limestone or quartzite. The dominant native vegetation is bunchgrasses, shrubs, and forbs. Gambel oak and conifers are scattered throughout the area. Some soils support an overstory of curlleaf mountainmahogany. The mean annual temperature is about 44 degrees F, and the average annual precipitation is about 25 inches. The frost-free period is about 70 days. Elevation ranges from 5,200 to 8,500 feet.

Agassiz soils make up about 40 percent of the map unit; Foxol soils, 30 percent; Rock outcrop, 25 percent; and minor soils, 5 percent.

The Agassiz and Foxol soils are dominantly on south- and west-facing convex mountainsides and canyon walls. The Rock outcrop is interspersed throughout the Agassiz and Foxol soils as ledges and outcroppings of bedrock.

The Agassiz and Foxol soils are shallow and somewhat excessively drained. The Agassiz soils are stony silt loam in the surface layer. The underlying layer is very cobbly silt loam. Limestone bedrock is at a depth of about 14 inches. Depth to bedrock ranges from 10 to 19 inches.

The Foxol soils are very cobbly loam in the surface layer. The subsoil is very cobbly loam. Fractured quartzite bedrock is at a depth of about 14 inches. Depth to bedrock ranges from 14 to 18 inches.

The Rock outcrop consists of exposures of bedrock as ledges and outcroppings of bedrock. It is more than 90 percent barren, but may support sparse amounts of bunchgrasses, curlleaf mountainmahogany, or Douglas-fir in pockets and cracks in the bedrock.

Durfee, Geertsen, and Lithic Haploxerolls are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. Recreational use is mainly hunting. Most of the soils are too steep for grazing by sheep or cattle. Water for livestock is generally available in springs and streams. Maintenance of good plant cover is desirable to keep erosion at a minimum.

The very steep slopes, shallow depth to bedrock, and the high amount of rock fragments in these soils limit their use for urban or recreational developments.

6. Isbell-Hades-Kilfoil

Very deep to moderately deep, well drained soils on mountainsides

This map unit is made up of strongly sloping soils on alluvial fans and stream terraces and very steep soils on mountainsides. It occurs mainly north of Croydon and Lost Creek drainage in Morgan County, and occupies about 5 percent of the survey area.

The soils in this map unit formed in alluvium and materials weathered from sandstone and some shale. The dominant natural vegetation is bunchgrasses, shrubs, forbs, and some aspen. The mean annual temperature is about 42 degrees F, and the average annual precipitation is about 25 inches. The frost-free season is about 70 days. Elevation ranges from about 5,400 to 8,300 feet.

Isbell soils make up about 30 percent of the map unit; Hades soils, 25 percent; Kilfoil soils, 20 percent; and Croydon soils, 20 percent. Minor soils make up about 5 percent of the map unit.

The Isbell soils occur dominantly on the south- and west-facing, very steep mountainsides. The Hades soils occur dominantly on concave, north-facing, very steep mountainsides. The Kilfoil soils occur mainly on south-, west-, and east-facing, very steep mountainsides and canyon walls. These soils occur under a cover of bunchgrasses, shrubs, and forbs. The Croydon soils occur on north-facing, very steep high mountainsides under a cover of aspen. The Rock outcrop occurs mostly with the Kilfoil soil on the ridges, and is interspersed throughout the Kilfoil soil as ledges and outcroppings of bedrock.

The Isbell soils are very deep and well drained. They are loam in the surface layer. The subsoil is clay loam. The substratum is silty clay in the upper part and loam in the lower part to a depth of 60 inches or more.

The Hades soils are very deep and well drained. They are loam in the surface layer. The subsoil is loam or clay loam to a depth of 72 inches or more.

The Kilfoil soils are moderately deep and well drained. They are loam in the surface layer. The subsoil is clay loam. The substratum is gravelly loam. Fractured sand-

stone bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 24 to 38 inches.

Croydon soils are deep and well drained. They are loam in the surface and subsurface layers. The subsoil is silty clay loam. The substratum is silt loam. Weathered sandstone bedrock is at a depth of about 48 inches. Depth to bedrock ranges from 48 to 60 inches or more.

This map unit is used mainly for range, wildlife habitat, and water supply. Recreational use is mainly hunting. Water for livestock is generally available from springs and streams.

Generally, the very steep slopes of most of the soils affect their use for urban or recreational developments. The moderate depth to bedrock in the Kilfoil soil also affects their use. Some flatter areas of the Hades and Isbell soils have development potential. However, septic tank filter field problems will develop because of their moderately slow permeability. Pollution from septic tanks is a hazard to streams in some places.

7. Etchen-Bullnel-Guilder

Moderately deep and deep, well drained soils on mountainsides

This map unit is made up of gently sloping to very steep soils on mountainsides and mountain ridgetops. It is mainly in the northeastern part of the survey area near the Morgan and Rich County line in Morgan County. It occupies about 5 percent of the survey area.

The soils in this map unit formed in materials weathered from sandstone. The dominant natural vegetation is bunchgrasses, shrubs, and forbs. The mean annual temperature is about 40 degrees F, and the average annual precipitation is about 20 inches. The frost-free season is about 75 days. Elevation ranges from about 5,800 to 8,000 feet.

Etchen soils make up about 45 percent of this map unit; Bullnel soils, about 35 percent; and Guilder soils, about 15 percent. Minor soils make up about 5 percent of the map unit.

The Etchen soils are moderately deep and well drained. They are cobbly loam in the surface layer. The subsoil is cobbly or very cobbly sandy clay loam. The substratum is very cobbly loam. Sandstone bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 21 to 38 inches.

Bullnel soils are moderately deep and well drained. They are mainly gravelly loam in the surface layer. The subsoil is gravelly loam and gravelly silty clay loam. The substratum is gravelly loam. Sandstone bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 32 to 40 inches. The eroded phase of Bullnel soils on the ridgetops is gravelly loam in the surface layer. The subsoil is gravelly heavy loam and the substratum is gravelly loam. Sandstone bedrock is at a depth of 25 inches. Depth to bedrock ranges from 21 to 25 inches.

The Guilder soils are deep and well drained. They are loam in the upper part of the surface layer and clay loam in the lower part. The upper part of the subsoil is heavy clay loam or silty clay loam. The lower part of the subsoil is silty clay loam, clay loam, or loam to a depth of 77 inches or more.

St. Marys and Redcan soils are among the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. Recreational uses are mainly hunting and snowmobiling on the flatter areas. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable. If disturbed or mismanaged, the soils in this map unit are potential sources of sediment.

Generally, the steep or very steep slopes and the moderate depth to bedrock limit the use of these soils for urban or recreational developments.

8. Durst-Smarts-Burgi

Moderately deep to very deep, well drained soils on mountainsides

This map unit is made up of very steep soils on mountainsides. It occurs mainly on the Durst Mountain area north of Morgan in Morgan County and occupies about 2 percent of the survey area.

The soils in this map unit formed mainly in materials weathered from quartzite and limestone. The natural vegetation is bunchgrasses, shrubs, forbs, and oakbrush. The mean annual temperature is about 42 degrees F, and the average annual precipitation is about 22 inches. The frost-free period is about 75 days. Elevation ranges from 5,400 to 8,200 feet.

The Durst soils are on south- or west-facing, very steep mountainsides under a cover of bunchgrasses and birchleaf mountainmahogany. The Smarts and Burgi soils are mainly on north- and east-facing, smooth and concave, very steep mountainsides under a cover of bunchgrasses and Gambel oak.

Durst soils make up about 35 percent of the area; Smarts soils, 25 percent; Burgi soils, 20 percent; and minor soils and Rock outcrop, 20 percent.

The Durst soils are moderately deep and well drained. They are gravelly loam in the surface layer. The subsoil is gravelly clay loam. Fractured quartzite is at a depth of about 25 inches. Depth to bedrock ranges from 20 to 32 inches.

The Smarts soils are deep and well drained. They are loam in the upper part of the surface layer and gravelly loam in the lower part. The subsoil is very gravelly clay loam. Fractured quartzite is at a depth of 41 inches. The depth to bedrock ranges from 40 to 50 inches.

The Burgi soils are very deep and well drained. They are loam in the upper part of the surface layer and cobbly loam in the lower part. The underlying layer is cobbly loam or very cobbly loam to a depth of 60 inches or more. In places, fractured bedrock occurs at a depth of 47 to 60 inches or more.

Horrocks, Caballo, Broad Canyon, Agassiz, and Foxol soils are the minor soils in this map unit. Rock outcrop is also throughout the map unit.

This map unit is used mainly for range, water supply, and wildlife habitat. Recreational use is mainly hunting. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable.

Very steep slopes, high rock fragment content, and depth to bedrock limit the use of these soils for urban or recreational developments. Septic tank absorption field problems will develop in these areas because of steep slopes and moderately slow permeability or depth to bedrock.

9. St. Marys-Moweba-Hoskin

Moderately deep to very deep, well drained soils on mountainsides

This map unit is made up dominantly of very steep soils on mountainsides. It occurs mainly in the Lost Creek drainage, Cottonwood drainage, and East Canyon Creek drainage in Morgan County and in the South Fork of the Ogden River drainage in Weber County. It occupies about 20 percent of the survey area.

The soils in this map unit formed in alluvium and materials weathered mostly from conglomerate, sandstone, and quartzite. The dominant natural vegetation is bunchgrasses, forbs, shrubs, and some areas of Gambel oak. The mean annual temperature is about 43 degrees F, and the average annual precipitation is about 25 inches. The frost-free season is about 80 days. Elevation ranges from 5,200 to 8,200 feet.

St. Marys soils make up about 40 percent of the map unit; Moweba soils, 20 percent; and Hoskin soils, 10 percent. Minor soils make up about 30 percent of the map unit.

The St. Marys and Hoskin soils occur mainly on the south- and west-facing, very steep mountainsides. Rock outcrop occurs mainly with the Hoskin soil as ledges and outcroppings of bedrock. The Moweba soils occur dominantly on the north- and east-facing, very steep mountainsides. Some small areas of strongly sloping to moderately steep Moweba soils occur on alluvial fans and benches in the mountains.

The St. Marys soils are deep or very deep and well drained. They are cobbly or very stony loam in the surface layer. The subsoil is very cobbly sandy clay loam and the substratum is very gravelly sandy loam to a depth of 60 inches or more.

The Moweba soils are very deep and well drained. The surface layer is gravelly loam. The subsoil is very gravelly loam to a depth of 65 inches or more.

The Hoskin soils are moderately deep and well drained. They are cobbly loam in the surface layer and very cobbly sandy clay loam in the subsoil. Bedrock is at a depth of about 28 inches. The depth to the bedrock ranges from 22 to 39 inches.

Holmes, Henefer, Henhoit, Morgala, Norcan, Toncana, Schuster, Etchen, and Redcan soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat and water supply. Recreational use is mainly hunting, but some snowmobiling is done on the flatter areas. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable to minimize soil erosion.

Generally, the very steep slopes and the high amount of rock fragments in these soils limit their use for urban or recreational developments. Pollution of streams is a hazard in places where the soils are used for septic tank filter fields.

Well drained soils on mountainsides, high mountainsides, and associated mountaintops, ridges, and canyon walls

These soils are on the high mountainsides and associated mountaintops, ridges, subalpine slopes, and canyon walls. They are loam, gravelly loam, cobbly loam, stony loam, extremely stony loam, silt loam, and gravelly fine sandy loam. These soils formed in residuum, colluvium, and alluvium from argillite, phyllite, schist, quartzite, gneiss, and sandstone.

Elevation is 5,200 to 9,300 feet. The average annual precipitation is 22 to 40 inches. The mean annual temperature is 40 to 45 degrees F, and the frost-free season is 40 to 85 days.

The five soil map units in this group make up 41 percent of the survey area.

10. Poleline-Smarts-Patio

Deep and moderately deep, well drained soils on mountainsides and high mountainsides

This map unit is made up of very steep soils on mountainsides and high mountainsides. It occurs mainly in the northwest portion of Morgan County and occupies about 6 percent of the survey area.

The soils in this map unit formed in materials weathered from argillite, phyllite, schist, quartzite, and gneiss. The dominant native vegetation is perennial grasses, shrubs, and forbs on the Poleline soils and Gambel oak on the Patio and Smarts soils. The mean annual temperature is about 43 degrees F, and the average annual precipitation is 20 to 30 inches. The frost-free season is about 70 days. Elevation ranges from about 5,200 to 9,000 feet.

Poleline soils make up about 55 percent of the map unit; Smarts soils, 20 percent; and Patio soils, 15 percent. Minor soils make up about 10 percent of this map unit.

The Poleline and Smarts soils are dominantly on north- and east-facing high mountainsides and mountainsides. The Patio soils are dominantly on the lower elevations and on south-facing mountainsides.

The Poleline soils are deep and well drained. They are stony loam in the upper part of the surface layer and

gravelly silt loam or very gravelly loam in the lower part. The subsoil is very gravelly loam. Fractured phyllite is at a depth of about 48 inches. The depth to bedrock ranges from 48 to more than 60 inches.

The Smarts soils are very deep and well drained. They are loam in the upper part of the surface layer and gravelly loam in the lower part. The subsoil is gravelly or very gravelly clay loam to a depth of 72 inches or more.

The Patio soils are moderately deep and well drained. The surface layer is gravelly loam. The subsoil is very gravelly clay loam fractured argillite at a depth of about 26 inches. The depth to the bedrock ranges from 20 to 40 inches.

Nordic, Lamondi, Toone, Condie, St. Marys, and Nagitsy soils are the minor soils in this map unit.

Soils in this map unit are used mainly for range, wildlife habitat, and water supply. Recreational use is mainly hunting. Some soils are being used for cabin sites and snow skiing developments. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable to minimize soil erosion.

Very steep slopes and high rock fragment content in the soils limit their use for urban or recreational developments. Septic tank filter field problems will develop in these soils because of their very steep slopes.

11. Lucky Star-Charcol

Very deep, well drained soils on high mountainsides

This map unit is made up of strongly sloping to very steep soils on high mountainsides. It occurs mainly in the northeastern and the southern parts of the survey area and occupies 25 percent of the survey area.

The soils in this map unit formed in materials weathered from conglomerate, quartzite, and sandstone. The dominant native vegetation is aspen, perennial grasses, shrubs, forbs, and scattered conifers. The mean annual temperature is 42 degrees F, and the average annual precipitation is 30 inches. The frost-free season is about 50 days. Elevation ranges from 6,000 to 9,200 feet.

Lucky Star soils make up about 55 percent of this map unit, and Charcol soils make up about 25 percent. Minor soils make up about 20 percent.

The Lucky Star soils are dominantly on north- and east-facing high mountainsides and high mountaintops under a cover of aspen. The Charcol soils are on north- and east-facing side slopes at lower elevations and on south- and west-facing side slopes at higher elevations.

Lucky Star soils are very deep and well drained. They are silt loam in the surface layer, gravelly loam in the subsurface layer, and very gravelly clay loam in the subsoil.

Charcol soils are very deep and well drained. They are gravelly fine sandy loam in the surface layer, very cobbly fine sandy loam in the subsurface layer, and gravelly loam in the subsoil.

Flygare, Condie, Ercan, Scave, Norcan, Morgala, Moweba, Yeljack, and St. Marys soils are the minor soils in this map unit.

This map unit is used mainly for range, water supply, and wildlife habitat. The Lucky Star soils are also used for woodland. Water for livestock and game animals is available from springs and streams. Maintenance of good plant cover is desirable. Recreational use is mainly hunting.

The very steep slopes are soil features that limit the use of these soils for home or cabin sites. Pollution is a hazard to water supplies if soils in this map unit are used for septic tank absorption fields, because of their very steep slopes.

12. Geertsen-Broad Canyon-Cristo

Moderately deep to very deep, well drained soils on mountainsides and high mountainsides

This map unit is made up of very steep soils on mountainsides, high mountainsides, and canyon walls. It occurs mainly at the head of the South Fork of the Ogden River in Weber County and at the head of Lost Creek drainage and on Durst Mountain in Morgan County. It occupies about 3 percent of the survey area.

Soils in this map unit formed in materials weathered from quartzite, argillite, phyllite, and schist. The dominant vegetation is conifers, perennial grasses, shrubs, and forbs. The mean annual temperature is about 43 degrees F, and the average annual precipitation is about 28 inches. The frost-free season is about 60 days. Elevation ranges from about 6,000 to 9,300 feet.

Geertsen soils make up about 40 percent of the map unit, and Broad Canyon and Cristo soils make up about 20 percent each. Minor soils and Rock outcrop make up about 20 percent.

The Geertsen and Broad Canyon soils are dominantly on very steep north- and east-facing high mountainsides under a cover of conifers. The Cristo soils occur mainly at the lower elevations on very steep mountainsides under a cover of bunchgrasses, forbs, and shrubs. Rock outcrop commonly is interspersed throughout the map unit, occurring as ledges and outcroppings of exposed bedrock on ridges and canyon walls.

Geertsen soils are deep or very deep and well drained. They are loam in the surface layer, and cobbly clay loam in the subsoil. Limestone is at a depth of about 45 inches. The depth to bedrock ranges from 40 to more than 60 inches.

The Broad Canyon soils are very deep and well drained. They are stony loam in the upper part of the surface layer and very cobbly loam in the lower part. The subsoil is very cobbly loam or very cobbly sandy loam to a depth of 60 inches or more.

The Cristo soils are moderately deep and well drained. They are loam in the surface layer. The subsoil is gravelly heavy silty clay loam. The substratum is very gravelly heavy silty clay loam. Fractured shale is at a depth of

about 35 inches. The depth to bedrock ranges from 29 to 35 inches.

Caballo, Wallsburg, and Agassiz soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, woodland, and watershed. Recreational use is mainly hunting. Water for livestock is generally available from springs and streams. Maintenance of good plant cover is desirable to keep erosion losses to a minimum.

Inaccessibility, very steep slopes, and high rock fragment content limit the use of these soils for urban or recreational developments. Problems will develop with septic tank filter fields in the soils in these areas because of their very steep slopes.

13. Herd-Richens-Yence

Deep to very deep, well drained soils on high mountaintops

This map unit is made up of gently sloping and moderately steep soils on high mountaintops and ridges. It occurs mainly on Herd Mountain in Morgan County and occupies about 4 percent of the survey area.

These soils formed in materials weathered from sandstone or glacial till from a conglomerate of sandstone and quartzite. The dominant vegetation is perennial grasses, shrubs, forbs, aspen, and scattered conifers. The mean annual temperature is 41 degrees F, and the average annual precipitation is 30 inches. The frost-free season is about 60 days. Elevation ranges from 7,000 to 9,000 feet.

Herd soils make up about 45 percent of the map unit; Richens soils, 30 percent; and Yence soils, about 25 percent.

The Herd soils are in slightly concave areas. The Yence soils occur on the slightly convex ridges and steeper side slopes. Both of these soils occur under a cover of bunchgrasses, shrubs, and forbs. Richens soils are on north- and east-facing side slopes under a cover of aspen and scattered conifers.

Herd soils are deep and very deep and well drained. They are cobbly loam in the surface layer and clay in the subsoil to a depth of 40 to 60 inches or more.

The Richens soils are deep and well drained. They are loam in the surface layer, cobbly silt loam in the subsurface layer. They are gravelly silty clay in the upper part of the subsoil and clay in the lower part. Sandstone occurs at a depth of 55 to 60 inches.

The Yence soils are deep and well drained. They are very stony loam in the surface layer. The subsoil is very gravelly or very cobbly heavy clay loam or cobbly clay. Sandstone is at a depth of 40 to 60 inches or more.

Lucky Star, Ercan, and Yeljack soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. The Richens soil is also used for the production of quaking aspen. Maintenance of good plant cover is desirable. Recreational uses are mainly hunting and snowmobiling.

The soils in this map unit have limited ability to support a load. They also have slow permeability that causes problems if they are used as septic tank absorption fields.

14. Nagitsy-Rock outcrop-Broad Canyon

Moderately deep and very deep, well drained soils on subalpine and high mountainsides and canyon walls

This map unit is made up of very steep soils on subalpine side slopes, very steep high mountainsides, and canyon walls. It occurs mainly on the west edge of the survey area in Weber and Morgan Counties, and occupies about 3 percent of the survey area.

The soils in this map unit formed in materials weathered from argillite, phyllite, schist, gneiss, and some quartzite. The dominant vegetation is perennial grasses, shrubs, forbs, and some areas of conifer. The mean annual temperature is about 40 degrees F, and the average annual precipitation is about 40 inches. The frost-free season is about 40 days. Elevation ranges from 6,400 to 9,800 feet.

Nagitsy soils make up about 55 percent of the map unit; Broad Canyon, soils 15 percent; Rock outcrop, 25 percent; and minor soils, about 5 percent.

The Nagitsy soils are on the east-facing subalpine side slopes and canyon walls under a cover of perennial grasses, black sagebrush, silver sagebrush, and other shrubs and forbs. The Broad Canyon soils occur dominantly on the east- and north-facing high mountainsides under a cover of conifers. Rock outcrop is interspersed throughout the map unit as ledges and outcroppings of bare exposed bedrock on ridges and canyon walls.

Nagitsy soils are moderately deep and well drained. They are stony loam in the upper part of the surface layer and gravelly loam in the lower part. The underlying layer is very gravelly loam. Bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 20 to 40 inches.

The Rock outcrop is interspersed throughout the map unit. It consists of argillite, phyllite, schist, gneiss, and quartzite on very steep slopes and canyon walls. The Rock outcrop is more than 90 percent barren, but supports sparse amounts of perennial grasses, curlleaf mountainmahogany, or Douglas-fir in some pockets and cracks.

The Broad Canyon soils are very deep and well drained. They are stony loam in the upper part of the surface layer and very cobbly loam in the lower part. The underlying layer is very cobbly loam or very cobbly sandy loam to a depth of 60 inches or more.

Patio and Poleline soils are the minor soils in this map unit.

This map unit is used mainly for range, wildlife habitat, and water supply. Recreational use is mainly hunting. Water for livestock and game animals is generally available from springs and streams. Maintenance of good plant cover is desirable to minimize soil erosion.

Inaccessibility, very steep slopes, depth to bedrock, and rock fragment content on the soil surface and in the soil

limit the use of these soils for urban or recreational developments. However, some of the soils occur on landscapes that have potential for snow skiing and other recreational developments. Problems will develop with septic filter fields because of very steep slopes.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a similar profile make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Manila loam, 3 to 6 percent slopes, is one of several phases within the Manila series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and soil associations.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Donner-Bertag cobbly loams, 10 to 40 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Etchen-Henhoit association, very steep, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 1, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

AaG—Agassiz-Rock outcrop complex, 40 to 70 percent slopes. This complex of Agassiz soils and Rock outcrop is on very steep south- and west-facing mountainsides and canyon walls at elevations of 5,400 to 8,000 feet. The Agassiz soil makes up about 70 percent of the complex and the Rock outcrop about 20 percent. The Rock outcrop is interspersed throughout the map unit as ledges and outcroppings of bare bedrock.

Included with this unit in mapping are small areas of Geertsen loam, 30 to 70 percent slopes, Burgi loam, 40 to 70 percent slopes, and Horrocks gravelly loam, 40 to 70 percent slopes.

The Agassiz soil is shallow and somewhat excessively drained. It formed in material weathered from limestone. The slopes are short or moderate in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is dark brown stony or very cobbly silt loam about 8 inches thick. The underlying layer is brown very cobbly silt loam 6 inches thick. Limestone is at a depth of about 14 inches. The depth to bedrock ranges from 14 to 19 inches. Rock fragment content is about 55 percent in the surface layer and 70 percent in the underlying layer. The surface layer is slightly acid, and the underlying layer is neutral.

Permeability is moderate above the bedrock. Effective rooting depth is 14 to 19 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, and antelope bitterbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbance, certain plants decrease and other plants increase. Proper grazing is the most important management practice for maintaining adequate plant cover and desired composition.

This soil supports plants that provide food and cover for mule deer, primarily during the winter, spring, and fall. It also provides habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger. Streams that run through the area provide habitat for beaver.

The depth to bedrock and the very steep slopes are major soil features causing severe limitations for any community, recreational, or sanitary facilities development on this soil.

This soil is important for water supply, but adequate plant cover needs to be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is limited to hunting. Streams that run through the area provide fishing.

The Rock outcrop interspersed throughout the complex consists of bare fractured limestone on very steep mountainsides and canyon walls. It is more than 90 percent barren, but pockets and cracks in the bedrock support small amounts of bluebunch wheatgrass, muttongrass, curlleaf mountainmahogany, or Douglas-fir.

Rock outcrop has esthetic value and is used with the Agassiz soil for wildlife habitat. Capability unit VIIs-X, nonirrigated.

AbG—Agassiz-Rock outcrop complex, shallow, 40 to 70 percent slopes. This complex of Agassiz gravelly loam and Rock outcrop is on south- and west-facing, very steep mountainsides and canyon walls at elevations of 5,200 to 7,800 feet. The Agassiz soil makes up about 70 percent of the complex and the Rock outcrop about 20 percent. The Rock outcrop is interspersed throughout the map unit as ledges and outcroppings.

Included with this unit in mapping are small areas of Agassiz stony loam, 40 to 70 percent slopes, Geertsen loam, 40 to 70 percent slopes, and Horrocks gravelly loam, 40 to 70 percent slopes.

The Agassiz soil is shallow and somewhat excessively drained. It formed in materials weathered in place from limestone. The slopes are short or moderate in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 70 days.

In a typical profile (fig. 1), the surface layer is very dark brown gravelly loam. Limestone bedrock is at a depth of about 10 inches. Depth to the bedrock ranges from 10 to 14 inches. Rock fragment content is about 40 percent. This soil is neutral throughout.

Permeability is moderate above the bedrock. Effective rooting depth is 10 to 14 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

The soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, antelope bitterbrush, and curlleaf mountainmahogany. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is the most important management practice in maintaining adequate plant cover and desired composition.

This soil supports plants that provide food and cover for mule deer, primarily during the winter, spring, and fall. It also provides habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

The depth to bedrock and very steep slopes are major features of this soil that limit their use for community, recreational, or sanitary facilities developments.

This soil is important for water supply, but adequate plant cover needs to be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is limited to hunting.

Rock outcrop consists of exposures of bare fractured limestone on very steep mountainsides and canyon walls. It is more than 90 percent barren, but sparse amounts of bluebunch wheatgrass, muttongrass, curlleaf mountainmahogany, or Douglas-fir occur in pockets and cracks.

Rock outcrop has esthetic value and is used with the Agassiz soil for wildlife habitat. Capability unit VIIs-M, nonirrigated.

AGG—Agassiz-Geertsen-Rock outcrop association, very steep. This association is on very steep mountainsides and canyon walls at elevations of 5,500 to 8,300 feet. The Agassiz stony silt loam, 40 to 70 percent slopes, makes up about 40 percent of the map unit. It occurs on very steep, convex, southwest- and east-facing side slopes under a cover of grasses and shrubs. The Geertsen loam, 40 to 70 percent slopes, makes up about 30 percent of the map unit. It occurs on very steep, concave, north-, northeast-, or northwest-facing side slopes under a cover of Douglas-fir. The Rock outcrop makes up about 20 percent of the association. It is interspersed throughout the map unit as ledges and outcroppings of bare bedrock.

Included with this association in mapping are small areas of Burgi loam, 40 to 70 percent slopes, and Horrocks gravelly loam, 40 to 70 percent slopes.

The Agassiz and Geertsen soils both formed in materials mostly weathered from limestone. The average annual precipitation is about 30 inches, and the average frost-free season is about 60 days. The mean annual air temperature is about 44 degrees F, for the Agassiz soil and 41 degrees F for the Geertsen soil.

The Agassiz soil is shallow and somewhat excessively drained. In a typical profile, the surface layer is dark

brown stony silt loam in the upper part and very cobbly silt loam in the lower part and is about 8 inches thick. The underlying layer is very cobbly silt loam about 6 inches thick. Limestone is at a depth of about 14 inches. The depth to bedrock ranges from 14 to 19 inches. This soil is slightly acid or neutral. Rock fragment content is about 55 percent in the surface layer and 70 percent in the underlying layer.

Permeability is moderate above bedrock. Effective rooting depth is 14 to 19 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, and antelope bitterbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is the most important management practice in maintaining adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter, spring, and fall. It also has potential as habitat for ruffed grouse, blue grouse, coyote, bobcat, weasel, badger, and porcupine. Streams that run through the area are potential habitat for beaver.

This soil is important for water supply, but adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

The Geertsen soil is deep and well drained. In a typical profile, the surface layer is black loam about 10 inches thick. The upper part of the subsoil is dark brown clay loam about 4 inches thick. The lower part of the subsoil is dark brown gravelly light clay loam about 14 inches thick. The substratum is dark brown very gravelly heavy loam. Highly fractured limestone is at a depth of about 45 inches. The depth to bedrock ranges from 40 to 60 inches or more. The surface layer is neutral, the upper part of the subsoil is slightly acid, and the lower part is slightly calcareous and neutral. The substratum is slightly calcareous and mildly alkaline. Rock fragment content is about 15 percent in the upper part of the subsoil, 45 percent in the lower part of the subsoil, and 65 percent in the substratum. The bedrock is highly fractured and has material similar to that in the substratum in the fractures and cracks.

Permeability is moderately slow. Effective rooting depth is 40 to 60 inches or more. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for woodland, wildlife habitat, and water supply.

Potential vegetation is Douglas-fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 1,960 cubic feet or 7,800 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope and high content of rock fragments. Expected mortality of tree seedlings is between 25 and 40 percent. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition may delay natural or artificial regeneration but will not prevent the eventual development of a fully stocked normal stand of trees. Use of conventional methods of tree harvest should be restricted due to excessive slope. High lead logging methods are more efficient and less damaging to the soil surface.

This soil has a potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat. The streams that run through the area are potential habitat for beaver.

This soil is important for watershed. Any recreational development or cabin site should be carefully planned and its impact on the environment fully evaluated. Careful management of timber resources and understory is necessary to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions should be made to safeguard the trees from harmful insects and fire.

The Rock outcrop interspersed throughout the association consists of bare fractured limestone on very steep mountainsides and canyon walls. It is more than 90 percent barren but in places supports small amounts of bluebunch wheatgrass, muttongrass, or curlleaf mountain-mahogany and a few Douglas-fir.

Inaccessibility, very steep slopes, shallow depth to bedrock, Rock outcrop, and high rock fragment content are the soil features that limit the use of this association for urban or recreational developments.

Recreational use of the soils in this association is hunting. Not placed in a capability unit.

AnD—Ant Flat loam, 6 to 15 percent slopes. This Ant Flat soil is deep and very deep and well drained. It occurs on gently rolling mountainsides at elevations of 5,300 to 7,500 feet. The slopes are short or medium in length. This soil formed in materials weathered from sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is 42 degrees F, and the average frost-free season is about 70 days.

Included with this soil in mapping are small areas of deep, well drained, fine textured and moderately fine textured soils that have slopes of 6 to 25 percent.

In a typical profile, the surface layer is dark brown loam about 10 inches thick. The subsoil is yellowish red heavy clay loam about 16 inches thick. The substratum is yellowish red and red clay loam to a depth of 60 inches or more. The surface layer and subsoil are noncalcareous. There is a layer of strong lime accumulation in the upper part of the substratum. Bedrock occurs at a depth of 40 to 60 inches or more.

Permeability is slow. Effective rooting depth is 40 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

The soil is used mainly for range, but small areas are used for nonirrigated crops.

Potential vegetation is dominantly bluebunch wheatgrass and basin wildrye. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Seeding is advisable where the range has severely deteriorated. Species suitable for seeding include alfalfa, smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Successful seeding of these plants depends on seedbed preparation, depth of seeding, and time of seeding. Proper grazing is an important management practice for maintaining adequate plant cover and desired composition.

The main nonirrigated crop is alfalfa. Small grains are used as nurse crops. Most previously cropped areas are now planted to intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer and fall. It also has potential as habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments. Some areas are currently planned for homesites. Dwellings and roads can be designed to offset the limited ability to support a load. Problems with septic tank absorption fields will develop in some areas because of slow permeability.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil loss to a minimum, thus maintaining its watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

BAF—Bertag silt loam, 10 to 30 percent slopes. This Bertag soil is very deep and well drained. It occurs on north- and east-facing foothills and mountainsides at elevations of 5,600 to 7,500 feet. The slopes are medium or long in length. This soil formed in materials weathered from tuffaceous sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of Manila loam, 25 to 40 percent slopes, Ostler loam, 20 to 50 percent slopes, and Hawkins silty clay, 15 to 30 percent slopes.

In a typical profile, the surface layer is very dark brown silt loam about 24 inches thick. The subsoil is very dark grayish brown or dark grayish brown heavy silty clay loam to a depth of 60 inches or more. In places, the soil has a brown, grayish brown, or light olive brown loam, silt loam, silty clay loam, sandy clay loam, or clay substratum below a depth of 50 inches. The surface layer is slightly acid and the subsoil is slightly acid or medium acid.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, bearded wheatgrass, basin wildrye, bigtooth maple, mountain snowberry, and Gambel oak. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for maintaining adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer during the spring, fall, and summer. It has potential for providing habitat for sage grouse, chukar, sharp-tailed grouse, coyote, bobcat, weasel, and badger. Streams in the area are potential habitats for beaver.

This soil has potential for urban and recreational developments. Some areas are used for cabin sites. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken when disturbing the soil on steep slopes because of the ready susceptibility to slippage. Problems develop with septic tank absorption fields in some areas because of slow permeability.

This soil is important for water supply, but adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining its watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Not placed in a capability unit (all in National Forest).

BbG—Bertag silt loam, 30 to 50 percent slopes. This Bertag soil is very deep and well drained. It occurs on north-facing foothills and mountainsides at elevations of 5,200 to 6,700 feet. The slopes are short or medium in length. This soil formed in materials weathered from tuffaceous sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 85 days.

Included with this soil in mapping are small areas of Manila loam, 25 to 40 percent slopes, Ostler loam, 20 to 50 percent slopes, and Hawkins silty clay, 15 to 30 percent slopes.

In a typical profile, the surface layer is very dark brown silt loam about 24 inches thick. The subsoil is very dark grayish brown or dark grayish brown heavy silty clay loam to a depth of 60 inches or more. In places, the soil may have a brown, grayish brown, or light olive brown loam, silt loam, silty clay loam, sandy clay loam, or clay substratum below a depth of 50 inches. The surface layer is slightly acid and the subsoil is slightly acid to medium acid.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate-

ly high. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, bearded wheatgrass, basin wildrye, bigtooth maple, mountain snowberry, and Gambel oak. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for maintaining adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer during the spring, fall, and summer. It also has potential for providing habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments. Some areas are used for cabin sites. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken when disturbing the soil on steep slopes because of the susceptibility to slippage. Problems may develop with septic tank absorption fields in some areas because of slow permeability.

This soil is important for water supply, but adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining its watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

BcE—Bertag cobbly loam, 20 to 40 percent slopes. This Bertag soil is very deep and well drained. It occurs mainly on north- and east-facing foothills or mountainsides at elevations of 5,650 to 7,200 feet. The slopes are short or medium in length. This soil formed in materials weathered from andesite or tuffaceous sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 80 days.

Included with this soil in mapping are small areas of Donner cobbly loam, 30 to 50 percent slopes, and Henefer loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown cobbly loam in the upper part and loam in the lower part and is about 25 inches thick. The upper part of the subsoil is dark brown heavy clay loam or silty clay about 21 inches thick, and the lower part is gravelly silty clay to a depth of 60 inches or more.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, bearded wheatgrass, Gambel oak, and mountain snowberry. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for maintaining adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer primarily during the spring, fall, and winter. It also has potential for providing habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

This soil is important for water supply, but adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining its watershed potential.

This soil has potential for urban and recreational developments. Some areas of this soil are used for cabin sites. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken in disturbing the soil on the steep slopes because of the ready susceptibility to slippage. Problems develop with septic tank absorption fields in some areas because of slow permeability.

Recreational use of this soil is mainly hunting. Capability unit VIe-M, nonirrigated.

BdG—Broad Canyon stony loam, 30 to 70 percent slopes. This Broad Canyon soil is very deep and well drained. It occurs on very steep north-facing high mountainsides at elevations of 6,500 to 9,000 feet. The slopes are short or medium in length. This soil formed in materials weathered from quartzite, argillite, phyllite, and schist. The average annual precipitation is about 35 inches, average annual air temperature is about 42 degrees F, and the average frost-free season is about 50 days.

Included with this soil in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, Nagitsy stony loam, 50 to 70 percent slopes, and Foxol very cobbly loam, 40 to 70 percent slopes.

In a typical profile, the surface layer is very dark grayish brown stony loam in the upper part and very dark grayish brown or dark brown very cobbly loam in the lower part. This layer is about 15 inches thick. The subsoil is brown very cobbly loam, and the substratum is very cobbly sandy loam to a depth of 60 inches or more. The surface layer, subsoil, and substratum are about 70 percent rock fragments. This soil is slightly acid.

Permeability is moderate in the upper part of the soil and moderately rapid in the lower part. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for woodland, water supply, and wildlife habitat.

Potential vegetation is Douglas-fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 870 cubic feet or 3,400 board feet (International Rule) per acre of merchantable timber from a fully stocked, even aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope, high content of

rock fragments, and the stony surface. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition will delay forest regeneration in places but will not prevent the eventual development of a fully stocked, normal stand of trees. Use of conventional methods of tree harvest should be restricted due to steep slope and stony soil surface. High lead logging methods are more efficient and less damaging to the soil surface.

Because of steep slopes, inaccessibility, and high content of rock fragments these soils are not used for urban developments. Pollution to water supplies is a hazard because of excessive seepage if septic tanks are used.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also has potential for providing habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat.

This soil is important for watershed. Any recreational development or cabin site should be carefully planned and its impact on the environment fully evaluated. Careful management of the timber resource and understory vegetation is essential to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

Recreational use of this soil is mainly hunting. Capability unit VIIs-H, nonirrigated.

BeB—Broadhead clay loam, 2 to 5 percent slopes. This Broadhead soil is very deep and well drained. It occurs on gently sloping or sloping stream terraces and alluvial fans at elevations of 5,200 to 5,400 feet. The slopes are medium or long in length. This soil formed in materials weathered from mixed sandstone, quartzite, and limestone. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Eastcan loam, cool, 0 to 3 percent slopes, and Utaba cobbly loam.

In a typical profile the surface soil is dark brown clay loam about 17 inches thick. The subsoil is dark brown silty clay about 26 inches thick. The substratum is reddish brown or pink clay loam to a depth of 60 inches or more. The upper part of the surface layer is moderately calcareous and mildly alkaline. This is probably due to the lime dust from the operations of a cement plant at Devils Slide nearby. The lower part of the surface layer and the subsoil are neutral. The substratum is strongly calcareous and moderately alkaline.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. The principal crops grown are alfalfa and small grain.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture and 2 to 3 years of small grain. Fall plowing, crop residue use, weed control, and minimum tillage are recommended to help control erosion and produce favorable growth of crops. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. All crops respond to nitrogen fertilizer. Legumes respond readily to phosphate fertilizer. Border and sprinkler irrigation methods are suited for this soil. Sprinkler irrigation is well suited to most crops. Border irrigation is suited to alfalfa, small grains, and pasture. Regardless of the irrigation method used, water should be applied carefully to avoid erosion on the steeper slopes. Land leveling is needed on some areas to obtain an even distribution of irrigation water. Irrigation intervals should be adjusted to the available water capacity of the soil, in order to replace the water used by the crop. Streamflow should not cause soil movement in furrows, corrugations, and borders. Length of irrigation runs should be such that water reaches the end of the field without overirrigating the upper part. These practices will help control soil erosion and help prevent excessive leaching of nutrients. Where irrigation distribution ditches are subject to erosion, pipe, ditch lining, or drops should be installed.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, porcupine, and coyote. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd corners provide cover and food and protect wildlife from predators and inclement weather. Food plants also provide some of the needed cover.

This soil is used for homesites and other urban developments. The limited ability to support a load limits the soil for urban or recreational developments. Dwellings and roads can be designed to offset this soil limitation. Problems with septic tank absorption fields will develop in some areas because of slow permeability.

Recreational use of this soil is mainly snowmobiling. Capability unit IIIe-3, irrigated.

BfA—Brownlee loam, 0 to 3 percent slopes. This Brownlee soil is very deep and well drained. It occurs on nearly level and gently sloping lake terraces and stream terraces at elevations of 4,900 to 5,150 feet. The slopes are long. This soil formed in materials weathered from argillite, phyllite, schist, and some quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 46 degrees F, and the frost-free season is about 105 days.

Included with this soil in mapping are small areas of Trojan loam, warm, 0 to 3 percent slopes, Brownlee loam, 3 to 6 percent slopes, Crooked Creek silty clay loam, and Nicodemus gravelly loam, 0 to 3 percent slopes.

In a typical profile, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is dark brown, brown, or dark grayish brown clay loam about 36 inches thick. The substratum is dark grayish brown loamy sand to a depth of 63 inches or more. The surface layer is

slightly acid and the subsoil and substratum are medium acid. Mottles occur in the lower subsoil or substratum in some places.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is moderate.

The soil is used mainly for irrigated crops. Alfalfa, hay or pasture, corn for silage, and grain are the principal crops grown.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage help control erosion and produce favorable growth of crops. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer. Legumes respond readily to phosphate fertilizer. Irrigation methods suitable for this soil are border, furrow, corrugation, and sprinkler. Sprinkler irrigation is well suited to most crops; furrow and corrugation methods are suited to row crops; and border irrigation is suitable for alfalfa, small grains, and pasture. Land leveling is needed on some areas to obtain an even distribution of irrigation water. Irrigation water applications should be adjusted to the available water capacity of the soil, water intake rate, and water needs of the crop grown. Streamflow should be regulated so that soil movement does not occur in furrows, corrugations, and borders. Length of irrigation runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These practices will help control erosion and excessive leaching of nutrients. Where irrigation distribution ditches are subject to erosion, pipe, ditch lining, or drops should be installed.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass and basin wildrye planted along fence rows and ditch banks and in odd corners provide cover, food, and shelter and protect the birds from predators and inclement weather. Food plants can also provide some of the needed cover.

This soil is well suited for homesites and other urban and recreational developments. Climatically adapted lawn grasses, shrubs, and trees for beautification grow well on this soil. Problems with septic tank absorption fields occur in some places because of the moderately slow permeability. Contamination of the ground water supply by cesspools is a hazard in areas where the soil has a loamy sand substratum and in areas of medium to high population density.

Recreational uses of this soil are mainly snowmobiling and hunting. Some areas are adjacent to Pineview Reservoir and have potential use for camp grounds to facilitate boating, fishing, water skiing, and swimming in the reservoir. Capability unit IIc-2, irrigated.

BfB—Brownlee loam, 3 to 6 percent slopes. This Brownlee soil is very deep and well drained. It occurs on sloping lake terraces and stream terraces at elevations of 4,890 to 5,150 feet. The slopes are short in length. This soil formed in materials weathered from argillite, phyllite, schist, and some quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 46 degrees F, and the frost-free season is about 105 days.

Included with this soil in mapping are small areas of a similar soil with slopes of 6 to 10 percent, occurring mainly in the drainageways adjacent to Pineview Reservoir; Lamondi stony loam, 3 to 15 percent slopes; Manila loam, 3 to 6 percent slopes; Brownlee loam, 0 to 3 percent slopes; and Crooked Creek silty clay loam.

In a typical profile, the surface layer is very dark brown loam about 14 inches thick. The subsoil is dark brown light clay loam about 39 inches thick. The substratum is olive brown loam to a depth of 65 inches or more. This soil is slightly acid in the surface layer, and the subsoil and substratum are medium acid.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is moderate.

The soil is used mainly for irrigated cropland. Alfalfa, hay or pasture, corn for silage, and grain are the principal crops grown.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are recommended to help control erosion and produce favorable growth of crops. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. Sprinkler irrigation is well suited to most crops; furrow and corrugation methods are suited to row crops; and border irrigation is suitable for alfalfa, small grains, and pasture. Land leveling is needed in some areas to obtain an even distribution of irrigation water. Irrigation applications and intervals should be adjusted to the available water capacity, water intake rate, and crop water requirements. Streams should be regulated so that soil movement does not occur in furrows, corrugations, and borders. Length of irrigation runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These practices help control erosion and excessive leaching of nutrients. Where irrigation distributin ditches are subject to erosion, pipe, ditch lining, or drops should be installed.

This soil has potential for growing plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd corners provide cover, food, and

shelter and protect the birds from predators and inclement weather. Food plants provide some of the needed cover.

This soil is suited for homesites and other urban and recreational developments. Climatically adapted lawn grasses, shrubs, and trees for beautification grow well in this soil. Some areas have problems with septic tank absorption fields because of the moderately slow permeability of this soil. Contamination of the ground water supply is a hazard in areas of medium to high population density if cesspools are used. Seepage contamination is especially a hazard in areas that have a loamy sand substratum.

Recreational uses of this soil are mainly snowmobiling and hunting. Areas adjacent to the Pineview Reservoir have potential for campgrounds to facilitate boating, fishing, waterskiing and swimming on the reservoir. Capability unit IIe-2, irrigated.

BnC2—Bullnel gravelly loam, 2 to 15 percent slopes, eroded. This Bullnel soil is moderately deep and well drained. It occurs mainly on ridgetops at elevations of 7,100 to 7,850 feet. The slopes are short or moderate in length. This soil is moderately eroded and some gullies occur. This soil formed in materials weathered from sandstone. The average annual precipitation is about 18 inches, mean annual air temperature is about 40 degrees F, and the average frost-free season is about 70 days.

Included with this soil in mapping are small areas of Etchen very cobbly loam, 25 to 50 percent slopes, Ercan loam, 3 to 15 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark reddish brown gravelly loam about 6 inches thick. The subsoil is red gravelly heavy loam about 7 inches thick. The substratum is red gravelly loam about 12 inches thick. Fractured sandstone bedrock occurs at a depth of about 25 inches. The depth to bedrock ranges from 21 to 25 inches. The surface layer is mildly alkaline and slightly calcareous or noncalcareous. The subsoil and substratum are generally moderately to strongly calcareous and moderately alkaline. Gravel content is about 20 percent in the surface layer and subsoil and 25 to 60 percent in the substratum.

Permeability is moderately slow above the bedrock. Effective rooting depth is 21 to 25 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, and antelope bitterbrush. When changes occur in the composition of potential vegetation due to use by livestock, wildlife or other disturbances, certain plants decrease and other plants increase. In areas where severe range deterioration has occurred, range seeding should be considered. Species suitable for seeding include intermediate wheatgrass, Regar brome, smooth brome, orchardgrass, slender wheatgrass, and mountain bromegrass. Proper grazing is an important management practice in maintaining adequate plant cover and desired composition. Brush management by aerial spraying or mechanical means is desirable in places where the understory of desirable plants is adequate.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during spring, summer, and fall. It also has potential habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger. Streams in the area have potential for beaver habitat.

Use of this soil for homesites is limited because of inaccessibility.

This soil is important as water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

BnG—Bullnel gravelly loam, 30 to 50 percent slopes. This Bullnel soil is moderately deep and well drained. It occurs mainly on north-facing mountainsides at elevations of 6,500 to 8,000 feet. The slopes are moderate or long in length. This soil formed in materials weathered from sandstone. The average annual air temperature is about 40 degrees F, and the average frost-free season is about 70 days.

Included with this soil in mapping are small areas of Etchen very cobbly loam, 25 to 50 percent slopes, Guilder loam, 15 to 30 percent slopes, Ercan loam, 15 to 30 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark reddish brown gravelly loam about 8 inches thick. The subsoil is reddish brown or dark red gravelly loam and gravelly silty clay loam about 26 inches thick. The substratum is dark red gravelly loam about 5 inches thick. Sandstone is at a depth of about 39 inches. There is a layer of strong lime accumulation in the upper substratum. Depth to sandstone ranges from 32 to 40 inches.

Permeability is moderately slow above the bedrock. Effective rooting depth is 32 to 40 inches. The available water capacity is low. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, muttongrass, Nevada bluegrass, and antelope bitterbrush. When changes occur in the potential vegetation composition due to grazing by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. In areas where range deterioration is severe, seeding should be considered. Species suitable for seeding are intermediate wheatgrass, Regar brome, smooth brome, orchardgrass, slender wheatgrass, and mountain bromegrass. Good grazing management is an important management practice for maintaining adequate plant cover and desired composition. Brush management should be considered in areas with excessive brush and an understory of desirable forbs and grasses.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the

fall and summer. It is also potential habitat for sage grouse, chukar, sharp-tailed grouse, porcupine, red fox, cottontail rabbit, coyote, bobcat, weasel, and badger. Streams in the area have potential for beaver habitat.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum and maintain the watershed potential.

Use for homesites is limited because of inaccessibility.

Recreational use of this soil is mainly hunting. The streams in the area provide some fishing. Capability unit VIIe-M, nonirrigated.

BuG—Burgi loam, 40 to 70 percent slopes. This soil is deep or very deep and well drained. It occurs on very steep north- and east-facing mountainsides at elevations of 5,600 to 7,600 feet. The slopes are medium and long in length. This soil formed in materials weathered from limestone. The average annual precipitation is about 22 inches, the mean annual air temperature is about 42 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of Agassiz stony silt loam, 40 to 70 percent slopes, Horrocks gravelly loam, 40 to 70 percent slopes, and Rock outcrop.

In a typical profile, the surface layer is very dark brown loam and cobbly loam about 20 inches thick. The underlying layer is dark brown or very dark grayish brown cobbly loam and very cobbly loam to a depth of 60 inches or more. Fractured bedrock occurs at a depth of 47 to 60 inches or more. This soil has slight or moderate amounts of lime below a depth of 25 inches, and is strongly calcareous below a depth of 40 inches in some places.

Permeability is moderate. Effective rooting depth is 47 inches to more than 60 inches. The available water capacity is moderate. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bearded wheatgrass, bluebunch wheatgrass, mountain brome, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. In areas of severe range deterioration, range seeding should be considered. Species suitable for seeding are smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and meadow foxtail. In areas with excessive amounts of brush and an understory of desirable grasses and forbs, brush management should be considered.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is a potential habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger. Streams in the area are potential habitats for beaver.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum.

Use for homesites is limited because of inaccessibility.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

CaG—Caballo gravelly loam, 40 to 70 percent slopes. This Caballo soil is deep and well drained. It occurs on very steep, north-facing mountainsides at elevations of 7,000 to 9,200 feet. This soil formed in materials weathered from limestone. The average annual precipitation is about 35 inches, mean annual air temperature is about 39 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Burgi loam, 40 to 70 percent slopes, Condie gravelly loam, 30 to 60 percent slopes, Geertsen loam, 30 to 70 percent slopes, and some Rock outcrop.

In a typical profile the surface layer is very dark brown or very dark grayish brown gravelly loam in the upper part and very dark grayish brown very cobbly loam in the lower part and is about 22 inches thick. The underlying layer is very dark grayish brown very cobbly loam about 31 inches thick. Fractured bedrock is at a depth of 53 inches. The depth to bedrock ranges from 40 to 55 inches. This soil is slightly acid in the surface layer. It is slightly or moderately calcareous and mildly or moderately alkaline in the underlying layer. Rock fragment content is about 25 percent in the upper part of the surface layer and 60 percent in the lower part and about 70 percent in the underlying layer.

Permeability is moderate. Effective rooting depth is 40 to 55 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for woodland, wildlife habitat, and water supply.

Potential vegetation is Douglas-fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 7,300 cubic feet or 36,100 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope and high content of rock fragments. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition in places delays tree regeneration, but will not prevent the eventual development of fully stocked, normal stands of trees. Use of conventional methods of tree harvest should be restricted due to excessive slope. High lead logging methods are more efficient and less damaging to the soil surface.

Because of steep slopes, inaccessibility, and high content of rock fragments, use of these soils for urban or recreational developments is limited.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is a potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat.

This soil is important for water supply. Any recreational development or cabin site should be carefully planned and its impact on the environment and water supply fully evaluated. Careful management of the timber resource and understory vegetation is necessary to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

Cb—Canburn silt loam. This Canburn soil is very deep and poorly drained. It occurs on nearly level, concave flood plains and valley bottoms at elevations of 4,800 to 6,200 feet. The slopes are 0 to 1 percent and are medium or long in length. This soil formed in alluvium weathered from mixed quartzite, sandstone, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 90 days.

Included with this soil in mapping are small areas of Eastcan loam, 0 to 3 percent slopes, Sunset loam, very gravelly substratum, Pringle loam, Crooked Creek silty clay loam, and Cumulic Haploborolls.

In a typical profile, the surface layer is very dark brown silt loam about 21 inches thick. The underlying layer is dark brown silt loam to a depth of 48 inches. Below this it is black silt loam to a depth of 60 inches or more. This soil is moderately calcareous and moderately alkaline. Some pedons are highly stratified silt loam, loam, very fine sandy loam, or clay loam in the underlying layers. Mottles are common in the lower part of the surface layer and in the underlying layers. Depth to the seasonal high water table ranges from 0.5 to 1.5 feet unless this soil is drained. Surface flooding from nearby streams frequently occurs in the late winter and spring during periods of rapid snowmelt.

Permeability is moderately slow. Effective rooting depth is mainly above the water table, generally 1 to 2 feet, but some roots extend to a depth of 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for pasture and grass hay.

If drained, this soil is suitable for irrigated alfalfa and small grain. Drainage is usually difficult due to lack of a drainage outlets. Improved species such as Garrison meadow foxtail, reed canarygrass, and red clover are recommended to increase forage production. Pasture should be properly grazed and fertilized to keep plants vigorous and healthy. Generally, legumes respond readily to phosphate, and grasses respond to nitrogen fertilizer. Border irrigation is desirable in some areas to supplement available water during the late summer to maintain high yields of pasture.

This soil has good potential for growing plants that provide food and cover for muskrats, mallard, and teal ducks. Such species as Russian-olive, reed canarygrass, and tall wheatgrass planted along fence rows and ditchbanks and in odd corners provide food and cover and improve wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather. Food plants provide some of the needed cover.

This soil has low potential for urban or recreational developments because of shallow depth to the water table and the hazard of flooding.

Recreational use is mainly hunting. Capability unit IVw-3, irrigated.

CdG—Causey silt loam, 30 to 60 percent slopes. This Causey soil is deep or very deep and well drained. It occurs on very steep, dominantly south- and west-facing foothills at elevations of 5,200 to 6,500 feet. The slopes are short in length. This soil formed in materials weathered from tuffaceous siltstone. The average annual precipitation is about 18 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Hawkins silty clay, 15 to 30 percent slopes; Choptie silt loam, 30 to 60 percent slopes; Ostler loam, 20 to 50 percent slopes; and some Rock outcrop.

In a typical profile, the surface layer is very dark brown or very dark grayish brown silt loam, about 19 inches thick. The underlying layer is dark grayish brown or pale brown loam to a depth of 40 inches. Below this it is pale brown gravelly or very gravelly loam to a depth of 60 inches. Depth to the layer of strong lime accumulation is 8 to 19 inches. Rock fragment content is 40 to 75 percent below a depth of about 40 inches.

Permeability is moderate. Effective rooting depth is 48 to more than 60 inches. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, antelope bitterbrush, and some mountain snowberry. When changes occur in the composition of potential vegetation due to grazing by livestock or wildlife or any other disturbances, certain plants decrease and other plants increase. Certain forbs, weeds, and shrubs can be managed through proper grazing, spraying, and other treatments if a reasonable understory of desired plants is present. Where severe range deterioration has occured on slopes of 30 to 40 percent, range seeding is advisable. Species suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during fall, winter, and spring. It also is a potential habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

This soil has limited potential for homesites because of steep slopes and inaccessibility.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

CeG—Causey-Choptie silt loams, 30 to 60 percent slopes. This complex occurs dominantly on very steep south- and west-facing, short foothills at elevations of 5,200 to 6,500 feet. The Causey soil is dominantly on even or slightly concave side slopes, and makes up about 50 percent of the complex. The Choptie soil occurs on slightly convex side slopes and ridges, and makes up about 40 percent of the complex. The slopes are short in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 90 days.

Included with these soils in mapping are small areas of Hawkins silty clay, 15 to 30 percent slopes, Ostler loam, 20 to 50 percent slopes, and some Rock outcrop.

The Causey soil is deep and well drained. It formed in materials weathered from tuffaceous sandstone and tuffaceous siltstone.

In a typical profile, the surface layer is very dark brown or very dark grayish brown silt loam about 19 inches thick. The underlying layer is dark grayish brown loam to a depth of 40 inches. Below this it is pale brown gravelly loam or very gravelly loam to a depth of 63 inches or more. In most places the surface layer is noncalcareous. Depth to a layer of strong lime accumulation is 8 to 19 inches. The surface layer is slightly acid to mildly alkaline. The underlying layers are mildly alkaline. Bedrock occurs at a depth of 48 to more than 60 inches.

Permeability is moderate. Effective rooting depth is 48 to more than 60 inches. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominantly bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush and mountain snowberry.

The Choptie soil is shallow and well drained. It formed in material weathered from tuffaceous sandstone and tuffaceous siltstone.

In a typical profile, the surface layer is black silt loam about 8 inches thick. The underlying layer is very dark gray silt loam about 6 inches thick. Bedrock is at a depth of about 14 inches. The depth to bedrock ranges from 14 to 20 inches. This soil is slightly acid.

Permeability is moderate above the bedrock. Effective rooting depth is 14 to 20 inches. The available water capacity is low. Surface runoff is moderate, and erosion hazard is high.

Potential vegetation is dominantly bluebunch wheatgrass, oniongrass, antelope bitterbrush, big sagebrush, Idaho fescue, and prairie junegrass.

This complex is used for range, water supply, and wildlife habitat.

When changes occur in the composition of the potential vegetation due to grazing of livestock or wildlife or other disturbances, certain plants increase and others decrease. In areas where the brush overstory is too high and a reasonable understory of desirable forbs and grasses are present, brush management is practical. Grazing management is an essential practice in maintaining good plant cover and the desired composition.

This complex has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also provides potential habitats for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

The steep slopes of this complex and the shallow depth to bedrock of the Choptie soil are limiting soil features that should be considered when planning the construction of homes, cabins, roads, and utilities. Deep cuts to provide level building pads and access roads would expose bedrock on the Choptie soils and in some places on Causey soils.

Adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the water supply potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

ChG—Charcol gravelly fine sandy loam, 30 to 50 percent slopes. This Charcol soil is very deep and well drained. It occurs on very steep south-facing high mountainsides and on north-facing side slopes at lower elevations. The elevation ranges from 7,000 to 8,500 feet. The slopes are short or moderate in length. This soil formed in materials weathered from sandstone and quartzite conglomerate. The average annual precipitation is about 30 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Lucky Star silt loam, 30 to 50 percent slopes, St. Marys cobbly loam, 30 to 50 percent slopes, and Moweba gravelly loam, 30 to 50 percent slopes.

In a typical profile the surface layer is very dark grayish brown or dark brown gravelly fine sandy loam about 21 inches thick. The subsurface layer is dark red very gravelly sandy loam or loamy fine sand about 23 inches thick. The subsoil is dark red gravelly loam about 10 inches thick. The substratum is dark red very gravelly light sandy loam to a depth of 62 inches or more. This soil is slightly acid to neutral. Rock fragment content is about 40 percent in the surface layer and 60 percent in the subsurface layer and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly slender wheatgrass, basin wildrye, mountain brome, and Gambel oak. When changes in composition of the potential vegetation occur due to grazing of livestock or wildlife or other disturbances, certain plants increase and others decrease. Range seeding is suitable where the range vegetation is in very poor condition. Aerial methods of seeding are advisable in large seedings. Grasses suitable for seeding are

mountain brome, smooth brome, Regar brome, and orchardgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during summer and fall. It also is a potential habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

The steep slopes and inaccessibility of this soil restrict its use for homesites and recreation.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining its watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

CnG—Cloud Rim loam, 30 to 60 percent slopes. This Cloud Rim soil is very deep and well drained. It occurs on very steep, south- and west-facing mountainsides. The elevation ranges from 5,600 to 6,900 feet. The slopes are moderate or long in length. This soil formed in materials weathered from gneiss, schist, and argillite. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 80 days.

Included with this soil in mapping are small areas of Smarts loam, 40 to 60 percent slopes, and Patio gravelly loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 15 inches thick. The subsoil is dark yellowish brown or brown clay loam about 41 inches thick. The substratum is brown cobbly loam to a depth of 66 inches or more. This soil is medium to slightly acid. Rock fragment content in the substratum is about 30 percent below a depth of 56 inches.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, bearded wheatgrass, Utah and mountain snowberry, bigtooth maple, serviceberry, and Gambel oak. When changes in the composition of potential vegetation occur due to grazing use by livestock or wildlife or other disturbances, certain plants increase and others decrease. In areas where brush species are in excess and a reasonable understory of desirable grasses and forbs is present, brush management is practical.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during spring, winter, and fall. It also is potentially a habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger.

Steep slopes and inaccessibility restrict the use of this soil for homesites.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. Capability unit VIIe-MQ, nonirrigated.

CoG—Condie gravelly loam, 30 to 60 percent slopes. This Condie soil is very deep and well drained. It occurs on very steep, north-facing high mountainsides at elevations of 6,800 to 8,100 feet. This soil formed in materials weathered from quartzite and sandstone conglomerate. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 60 days.

Included with this soil in mapping are small areas of Geertsen loam, 30 to 70 percent slopes, and Lucky Star silt loam, 30 to 60 percent slopes.

In a typical profile the surface layer is dark yellowish brown gravelly loam about 8 inches thick. The subsurface layer is reddish brown gravelly fine sandy loam about 17 inches thick. The subsoil is dark red gravelly clay loam about 17 inches thick. The upper part of the subsoil is mixed with the subsurface layer. The substratum is red very gravelly loam to a depth of 66 inches or more. This soil is slightly acid in the surface layer, subsurface layer, and subsoil. It is moderately calcareous and neutral in the substratum. Rock fragment content is about 20 percent in the surface layer and subsurface layer, 40 percent in the subsoil, and 80 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for woodland, wildlife habitat, and water supply.

Potential vegetation is Douglas-fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 1,960 cubic feet or 7,800 board feet (International Rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope and high content of rock fragments. Expected mortality of naturally occurring or planted tree seedlings is between 25 and 50 percent. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition may delay natural or artificial regeneration but will not prevent the eventual development of a fully stocked normal stand of trees. Use of conventional methods of tree harvest should be restricted due to excessive slope. High-lead logging methods are more efficient and less damaging to the soil surface (fig. 2).

Because of the steep slopes, high content of rock fragments, and inaccessibility, this soil is not used for urban or recreational developments. Pollution is a hazard to water supplies where septic tanks are used.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat. Streams throughout the area provide habitat for beaver.

This soil is important for water supply. Recreational developments or cabin sites should be carefully planned and their impact on the environment fully evaluated. Careful management of the timber resource and understory vegetation is essential to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

CrG—Cristo-Wallsburg complex, 40 to 60 percent slopes. This complex of Cristo and Wallsburg soils occurs dominantly on the very steep mountainsides at elevations of 7,000 to 7,800 feet. The Cristo soil occurs on even and slightly concave side slopes and makes up about 65 percent of the complex. The Wallsburg soil occurs on slightly convex side slopes and ridges and makes up about 30 percent.

Included with these soils in mapping are small areas of Geertsen loam, 30 to 70 percent slopes, and Lithic Haploxerolls-Rock outcrop complex, 40 to 80 percent slopes.

The Cristo soil is moderately deep and well drained. It formed in materials weathered from limestone and shale. The slopes are short or moderate in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is very dark grayish brown loam about 13 inches thick. The subsoil is dark brown gravelly heavy silty clay loam about 8 inches thick. The substratum is dark brown very gravelly heavy silty clay loam to a depth of 35 inches. Fractured shale occurs at a depth of 35 inches. Depth to the bedrock ranges from 29 to 35 inches. Rock fragment content is about 30 percent in the subsoil and about 70 percent in the substratum. The surface layer and subsoil are slightly acid. The substratum is mildly alkaline and moderately calcareous.

Permeability is moderately slow above the bedrock. Effective rooting depth is restricted by bedrock at a depth of 29 to 35 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominantly bluebunch wheatgrass, longtongue muttongrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some antelope bitterbrush. When changes occur in the composition of the potential vegetation due to grazing by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice to help maintain adequate plant cover and desired composition. Where brush species have increased considerably and the understory of the desired grasses and forbs is present, brush management is practical.

Wallsburg soil is shallow and well drained. This soil formed in materials weathered from limestone and shale. The slopes are short or moderate in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is very dark grayish brown gravelly loam or gravelly silty clay loam about 10 inches thick. The subsoil is dark grayish brown very gravelly heavy silty clay loam about 5 inches thick. Highly fractured limestone is at a depth of about 15 inches. Depth to the bedrock ranges from 15 to 20 inches. Rock fragment content is about 30 percent in the surface layer and 70 percent in the subsoil. The surface layer is slightly calcareous and neutral. The subsoil is noncalcareous except for the limestone fragments. The subsoil is neutral.

Permeability is moderately slow above the bedrock. Effective rooting depth is restricted by bedrock at a depth of 15 to 20 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, antelope bitterbrush, basin wildrye, Nevada bluegrass, big sagebrush, and some mountain snowberry. When changes occur in the composition of the potential vegetation due to grazing by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas where brush species are excessive and a reasonable understory of desirable grasses and forbs is present.

The soils in this complex are used for range, water supply, and wildlife habitat.

The soils are not presently used for homesites because of inaccessibility and steep slopes.

The soils are important for water supply, but adequate plant cover needs to be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during summer and fall. They also are potential habitats for sage grouse, sharp-tailed grouse, coyote, bobcat, weasel, badger, cottontail rabbit, and porcupine. The intermittent and perennial streams in the area provide habitat for beaver.

Recreational use of these soils is mainly hunting. Capability unit VIIe-M, nonirrigated.

Ct—Crooked Creek silty clay loam. This soil is very deep and poorly drained. It occurs on flood plains and valley bottoms at elevations of 4,880 to 5,050 feet. This soil formed in alluvium weathered from sandstone, quartzite, and limestone rocks. The slopes are 0 to 1 percent, and are long. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Eastcan loam, 0 to 3 percent slopes, Brownlee loam, 0 to 3 percent slopes, Canburn silt loam, and a very deep poorly drained fine textured strongly calcareous soil.

In a typical profile (fig. 3), the surface layer is very dark brown or black silty clay loam about 14 inches thick. The underlying layer is black or very dark gray silty clay or clay loam to a depth of 52 inches. Below this it is dark grayish brown or brown sandy loam to a depth of 63 inches or more. Mottles occur throughout the profile. Depth to seasonal high water table ranges from 0 to 20 inches. The surface layer and underlying layer are slightly acid to a depth of about 52 inches. Below this, the underlying layer is neutral.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is very slow. Erosion hazard is slight or moderate.

This soil is used mainly for wet meadow pasture. Some small drained areas are used for irrigated small grains and corn for silage.

The potential vegetation is tufted hairgrass, sedges, rushes, redtop, and western wheatgrass. The wet meadow grasses respond readily to nitrogen fertilizer, and require supplemental irrigation water during the late summer for full production. Seeding reed canarygrass in pastures will usually improve quality and production.

This soil has some potential for supporting plants that provide habitat for ring-necked pheasant and mallard and teal ducks. Some of the open drains in the area provide potential muskrat habitat.

The shallow depth to the water table, slow permeability, the limited ability to support a load, and occasional flooding restrict the use of this soil for urban developments.

Recreational use of this soil is mainly for hunting. Capability unit IVw-3, irrigated.

CvG—Croydon loam, 30 to 60 percent slopes. This Croydon soil is deep and well drained. It occurs on north-facing, very steep mountainsides at elevations of 6,400 to 8,300 feet. This soil formed in materials weathered from sandstone. The slopes are short and medium in length. The average annual precipitation is about 30 inches, mean annual air temperature is about 40 degrees F, and the average frost-free season is about 70 days.

Included with this soil in mapping are small areas of Hades loam, 40 to 60 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, Isbell loam, 40 to 60 percent slopes, Moweba gravelly loam, 30 to 50 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown loam about 16 inches thick. The subsurface layer is brown loam about 6 inches thick. The subsoil is light olive brown silty clay loam about 18 inches thick. The substratum is light olive brown heavy silt loam about 8 inches thick. Weathered sandstone is at a depth of about 48 inches. Depth to bedrock ranges from 48 to more than 60 inches. This soil is slightly acid.

Permeability is moderately slow. Effective rooting depth is 48 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for grazing, woodland, wildlife habitat, and water supply.

Potential vegetation is quaking aspen with an understory of blue wildrye, mountain brome, bearded wheatgrass, nodding bluegrass, and nodding bromegrass (fig. 4). When changes in the composition of the potential vegetation occur due to grazing by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice to help maintain adequate plant cover and desired composition.

This soil is also used for the production of quaking aspen. It is capable of producing about 1,600 cubic feet or 200 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition may delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods used in tree harvest can only be used with difficulty because of the slope. High lead logging is more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshow hare, coyote, bobcat, weasel, porcupine, and badger. The streams in the area provide potential habitat for beaver.

Potential for homesites is limited because of inaccessibility and steep slopes.

This soil is important for water supply, but adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is limited to hunting. Capability unit VIIe-HA, nonirrigated.

CW—Cumulic Haploborolls, wet. Cumulic Haploborolls, wet, are deep, somewhat poorly drained and moderately well drained soils. They have a deep, dark brown surface layer 20 inches or more thick. They occur in undulating flood plains in the bottoms of canyons and drainageways in mountainous areas at elevations of 5,200 to 7,500 feet. The slopes are short in length and range from 1 to 6 percent. These soils formed in mixed alluvium weathered from sandstone, quartzite, limestone, argillite, phyllite, and schist rocks. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 90 days.

Included with these soils in mapping are small areas of Fluvaquentic Haploborolls and Fluventic Haploxerolls, 1 to 6 percent slopes, Cumulic Haploxerolls, loamy, Utaba cobbly loam, and Canburn silt loam.

These soils are variable in texture and are stratified in the lower layers. No one profile represents this map unit, but one of the more common ones has a surface layer that is dark brown or very dark brown loam in the upper part and very fine sandy loam in the lower part and that is about 23 inches thick. The underlying layer, about 18 inches thick, is stratified dark brown very fine sandy

loam or fine sandy loam. Below this is dark brown, very gravelly sand to a depth of 60 inches or more. These soils are moderately calcareous and moderately alkaline. The rock fragment content varies but is about 15 percent in the underlying layer and 75 percent below a depth of 41 inches. These soils are highly stratified clay loam, loam, or sandy loam. Very gravelly sand usually occurs below a depth of 41 inches. Texture varies significantly within short distances. Layers of darkened soil with increased organic matter occur on the surface and erratically throughout the soils. A seasonal high water table is at a depth of 1 to 3 feet, and occurs during late winter and spring. Flooding is frequent during the late winter and spring.

Permeability is variable. Effective rooting depth is mostly concentrated above the water table but extends to depth of 60 inches or more. The available water capacity is variable, but it is mostly moderate or moderately high. Surface runoff is slow. Erosion hazard is high.

These soils are used mainly for range.

Potential vegetation is narrowleaf cottonwood, willow, and some water birch with an understory of blue wildrye, bearded wheatgrass, mountain brome, muttongrass, and slender wheatgrass. When changes occur in the composition of potential vegetation due to grazing of livestock or wildlife or other disturbances, certain plants increase and others decrease.

These soils have potential for supporting plants that provide food and cover for mule deer, elk, and moose during all seasons of the year. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Adjacent streams are potential habitat for beaver.

The high water table and frequent flooding are soil features that limit the potential use of the soil for urban development. Septic tank absorption fields would not function properly under these conditions and result in a pollution hazard to water supplies.

Recreational uses are mainly camping, picnicking, fishing, paths, trails, and horseback and trailbike riding. Capability unit VIw-4, nonirrigated.

CX—Cumulic Haploxerolls, loamy. Cumulic Haploxerolls, loamy, are deep, well drained soils. They have a deep, dark brown surface layer more than 20 inches thick. They are sloping, strongly sloping, and moderately steep and are on alluvial flood plains, stream terraces, and alluvial fans that are in mountain valleys and on canyon bottoms at elevations of 4,950 to 7,200 feet. These soils formed in alluvium weathered from sandstone, quartzite, and limestone. Slopes range from 3 to 15 percent and are short or medium in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 90 days.

Included with these soils in mapping are small areas of Cumulic Haploborolls, wet, Fluvaquentic Haploborolls and Fluventic Haploxerolls, 1 to 6 percent slopes, Hades loam, 6 to 15 percent slopes, Isbell loam, gravelly substratum, 6 to 15 percent slopes, and Moweba gravelly loam, 6 to 15 percent slopes.

No one profile represents this map unit, but one of the more common ones has a surface layer that is variable in texture but is mostly loamy. Generally it is dark brown loam to a depth of about 18 inches. The underlying layer is dark yellowish brown gravelly loamy sand about 6 inches thick. This is underlain to a depth of about 41 inches by very dark grayish brown silt loam, which is an older buried surface layer. Below this, to a depth of 60 inches or more, is dark brown gravelly loam. These soils are strongly calcareous and moderately alkaline. Rock fragment content between depths of 18 and 24 inches is about 25 percent, and it is about 45 percent below a depth of 24 inches. These soils are highly stratified clay loam, loam, or sandy loam with 0 to 35 percent rock fragments, usually dominated by cobbles. In some small areas very gravelly sand is below a depth of 40 to 50 inches. Darkened soil and increased organic-matter content occur in the surface layer and erratically throughout the profile. Flooding by runoff and from nearby streams occasionally occur during late winter and spring.

Permeability is variable, but generally is moderate. Effective rooting depth is 60 inches or more. The available water capacity is variable but mostly moderately high or high. Surface runoff is slow. Erosion hazard is high.

These soils are used for range.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. In areas where shrubby plants have taken over the plant community and a reasonable understory of desirable forbs and grasses is present, brush management is suitable. Seeding is advisable where vegetation deterioration is severe and a seed source of suitable plants is absent. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Successful seedings require a good seedbed, placing of seed at proper depth, and proper rate of seeding.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, coyote, weasel, and badger. The adjacent streams are potential habitat for beaver.

The hazard of occasional flooding is the main soil feature that limits the potential of these soils for urban or recreational developments. Septic tank absorption fields would not function properly because of the flooding. Pollution of the water supply is a hazard because these soils are adjacent to streams.

Recreational uses of these soils are mainly hunting, snowmobiling, and trailbike and horseback riding. Capability unit VIw-M, nonirrigated.

DaG—Donner cobbly loam, 30 to 50 percent slopes. This Donner soil is moderately deep and well drained. It occurs on south-facing, very steep foothills and mountainsides at elevations of 5,650 to 7,200 feet. This soil formed in materials weathered from tuffaceous sandstone and andesite. The average annual precipitation is about 20 inches, mean annual air temperature is about 42 degrees F, and the average frost free season is about 80 days.

Included with this soil in mapping are small areas of Bertag cobbly loam, 20 to 40 percent slopes, Donner cobbly loam, 10 to 30 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown cobbly loam about 6 inches thick. The subsoil is very dark brown or dark brown clay loam and silty clay about 28 inches thick. Soft, weathered tuffaceous sandstone is at a depth of 34 inches. The depth to bedrock ranges from 30 to 40 inches. This soil is medium or slightly acid. Rock fragment content is about 25 percent in the surface layer and 5 to 20 percent in the subsoil.

Permeability is slow above the bedrock. Effective rooting depth is restricted by bedrock at a depth of 30 to 40 inches. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, basin wildrye, bearded wheatgrass, and some arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. In areas where the brush species have increased excessively and there is still a reasonable understory of desirable forbs and grasses, brush management is practical. Where severe vegetation deterioration has occurred and the seed source of desirable plants is absent, range seeding is practical. Species suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Steep slopes, depth to bedrock, and limited ability to support a load limit the potential use of this soil for urban development. Septic tank absorption field problems will develop in some areas because of slow permeability.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

DbE—Donner-Bertag cobbly loams, 10 to 40 percent slopes. This complex of Donner and Bertag soils occurs on all exposures on steep mountain foot slopes at elevations of 5,650 to 7,050 feet. The Donner soil occurs on the convex ridges and knolls dominantly on south and west exposures with 10 to 30 percent slopes. It makes up about 60 percent of the complex. The Bertag soil occurs on concave north and east exposures with 20 to 40 percent slopes. The Bertag soil makes up about 30 percent of the complex.

Included with these soils in mapping are small areas of Hawkins silty clay, 6 to 15 percent slopes, and Hawkins silty clay, 15 to 30 percent slopes.

The Donner soil is moderately deep and well drained. It formed in materials weathered from tuffaceous sandstone and andesite. The slopes are short or medium in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 90 days.

In a typical profile, the surface layer is very dark brown cobbly loam about 6 inches thick. The subsoil is dark brown heavy clay loam or light clay. At a depth of 36 inches is soft, weathered tuffaceous sandstone. The depth to the bedrock ranges from 23 to 40 inches. This soil is medium acid and slightly acid. Rock fragment content is about 25 percent in the surface layer.

Permeability is slow above the bedrock. Effective rooting depth is 23 to 40 inches. The available water capacity is moderate or moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the composition of potential vegetation due to use by livestock or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Where brush species dominate the vegetation and there is a reasonable understory of desirable forbs and grasses, brush management is practical. Where vegetation has deteriorated severely and a seed source of desirable plants is absent, range seeding is practical. Species suitable for seeding are smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, and intermediate wheatgrass. Successful seeding depends on seedbed preparation, time of seeding, rate of seeding, and method of seeding.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, and badger.

Depth to bedrock and limited ability to support a load limit the potential use of this soil for urban developments. Septic tank absorption field problems will develop in some areas because of slow permeability.

The Bertag soil is very deep and well drained. This soil formed in materials weathered from tuffaceous sandstone and andesite. The slopes are short or medium in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 90 days.

In a typical profile, the surface layer is very dark brown cobbly loam in the upper part and loam in the lower part and is about 12 inches thick. The subsoil is dark brown clay loam in the upper part and clay in the lower part and is about 37 inches thick. The substratum is dark brown cobbly clay to a depth of 60 inches or more. This soil is slightly or medium acid. Rock fragment content is about 20 percent in the surface layer and subsoil and 45 percent in the substratum.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high or high. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bluebunch wheatgrass, bearded wheatgrass, mountain snowberry, bigtooth maple, and Gambel oak. When changes occur in the compostion of potential vegetation due to use by livestock or other disturbances, certain plants decrease and other plants increase. Proper grazing management is an important management practice in helping to maintain adequate plant cover and desired composition. Where brush species increase and dominate the vegetation and a reasonable understory of desirable grasses and forbs is present, brush management is a suitable practice.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall and winter. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, and badger.

Limited ability to support a load, steep slopes, and ready susceptibility to slippage limit the potential use of this soil for urban development. Septic tank absorption field problems will develop in some areas because of slow permeability.

The soils in this complex are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of these soils are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

DeG—Durfee stony loam, 30 to 70 percent slopes. This Durfee soil is very deep and well drained. It occurs mainly on east-, south-, and west-facing mountainsides and mountain foot slopes at elevations of 5,200 to 6,500 feet. This soil formed in materials weathered from sandstone and quartzite. The slopes are medium and long in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Yeates Hollow very stony loam, 30 to 70 percent slopes, Foxol very cobbly loam, 40 to 60 percent slopes, Henefer loam, 40 to 60 percent slopes, Manila loam, 25 to 40 percent slopes, and St. Marys cobbly loam, 30 to 50 percent slopes.

In a typical profile (fig. 5), the surface layer is dark brown stony loam in the upper part and very gravelly loam in the lower part and is about 16 inches thick. The subsoil is dark reddish brown very gravelly heavy clay loam in the upper part and yellowish red, red, or dark red very gravelly clay in the lower part and extends to a depth of 60 inches or more. This soil is medium acid, slightly acid, or neutral. Rock fragment content is about 65 percent in the surface layer and about 75 percent in the subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, birchleaf mountainmahogany, muttongrass, Nevada bluegrass, longtongue muttongrass, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Where brush species increase and dominate the vegetation and a reasonable understory of desirable forbs and grasses is present, brush management is practical. Where the vegetation has seriously deteriorated and a seed source of desirable plants is absent, seeding is practical. Because of very steep slopes and stony loam surface soils, the only practical range seeding methods are broadcast or aerial. Species suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Steep slopes and concentration of rock fragments limit the potential use of this soil for urban development. Septic tank absorption field problems will develop in some areas because of slow permeability.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

DmG—Durfee-Moweba complex, 30 to 70 percent slopes. This complex of Durfee and Moweba soils occurs dominantly on very steep mountainsides at elevations of 5,600 to 7,500 feet. The Durfee soil occurs on medium and long south- and west-facing, convex ridges. Slopes are 30 to 70 percent. It makes up about 40 percent of the complex. The Moweba soil occurs on medium and long, north- and east-facing, concave side slopes. Slopes are 30 to 50 percent. It makes up about 40 percent of the complex.

Included with these soils in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, Manila loam, 10 to 25 percent slopes, Yeates Hollow very stony loam, 30 to 70 percent slopes, and Hoskin cobbly loam, 30 to 50 percent slopes.

The Durfee soil is very deep and well drained. It formed in materials weathered from sandstone and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 85 days.

In a typical profile, the surface layer is dark brown stony loam in the upper part and cobbly heavy loam in the lower part and is about 16 inches thick. The subsoil is dark brown or yellowish red very cobbly clay to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 45 percent in the surface layer and 50 percent in the subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, birchleaf mountainmahogany, muttongrass, longtongue muttongrass, Nevada bluegrass, and some arrowleaf balsamroot, antelope bitterbrush, and scattered Gambel oak. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for helping to maintain good plant cover and desired composition. Where brush species dominate the vegetation and a reasonable understory of desirable grasses and forbs is present, brush mangement is practical.

The Moweba soil is very deep and well drained. It formed in material weathered from quartzite and sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 80 days.

In a typical profile, the surface layer is very dark brown gravelly loam about 31 inches thick. The subsoil is brown very gravelly loam to a depth of 72 inches or more. This soil is slightly acid. Rock fragment content is about 20 percent in the upper part of the surface layer, about 40 percent in the lower part of the surface layer, and about 50 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow to medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush and mountain snowberry. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing management is an important management practice for helping to maintain adequate plant cover and desired composition. Where brush species increase and dominate the vegetation and a reasonable understory of grasses and forbs is present, brush management is practical. Where vegetation has seriously deteriorated and a seed source of desirable plants is absent, seeding is practical. Successful seeding depends on proper time of seeding. Broadcast and aerial seeding are suitable for these steep lands. Species suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

Steep slopes of both soils and presence of stones on the surface and the large amounts of rock fragments in the subsoil of the Durfee soil limit the use of these soils for urban development. The Moweba soil has moderately rapid permeability below a depth of 31 inches. Septic tank absorption fields generally perform well, but seepage could cause pollution of the water supply. Septic tank absorption fields in the slowly permeable Durfee soils would function poorly.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail rabbit, jackrabbit, porcupine, coyote, bobcat, weasel, and badger.

These soils are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum and to protect the watershed.

Recreational use of this soil complex is mainly hunting. Capability unit VIIe-M, nonirrigated.

DuG—Durst gravelly loam, 40 to 70 percent slopes. This soil is moderately deep and well drained. It occurs on south- or west-facing, very steep mountainsides at elevations of 6,000 to 7,700 feet. This soil formed in materials weathered from quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 80 days.

Included with this soil in mapping are small areas of Foxol very cobbly loam, 40 to 70 percent slopes, Smarts loam, moderately deep, 40 to 70 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark grayish brown gravelly loam about 10 inches thick. The subsoil

is dark brown gravelly clay loam about 15 inches thick. Fractured quartzite is at a depth of about 25 inches. The depth to bedrock ranges from 20 to 32 inches. This soil is strongly acid or medium acid. Rock fragment content is about 40 percent in the surface layer and about 45 percent in the subsoil.

Permeability is moderately slow above the bedrock. Effective rooting depth is restricted by bedrock at a depth of 20 to 32 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, oniongrass, antelope bitterbrush, big sagebrush, Idaho fescue, prairie junegrass, and some arrowleaf balsamroot and birchleaf mountainmahogany. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Where brush species increase and dominate the vegetation and an understory of desirable grasses and forbs is present, brush management is practical.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail rabbit, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Inaccessibility, steep slopes, concentration of rock fragments, and moderate depth to bedrock are features that limit the potential of this soil for urban developments. Septic tank absorption fields will develop problems in many areas because of the moderately slow permeability, moderate soil depth, and steep slopes.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

EaA—Eastcan loam, 0 to 3 percent slopes. This Eastcan soil is very deep and moderately well drained. It occurs on nearly level and gently sloping flood plains, valley bottoms, and stream terraces at elevations of 4,800 to 5,150 feet. This soil formed in alluvium weathered from sandstone, quartzite, and limestone. The slopes are medium or long in length. The average annual precipitation is about 18 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 105 days.

Included with this soil in mapping are small areas of Sunset loam, very gravelly substratum, Pringle loam, Canburn silt loam, Redola loam, 0 to 2 percent slopes, Nebeker clay loam, 0 to 3 percent slopes, Parleys loam, high rainfall, 0 to 3 percent slopes, Hawkins silty clay, 3 to 6 percent slopes, and soils that are very gravelly sandy loam or very gravelly loamy fine sand below a depth of 40 inches.

In a typical profile, the surface layer is very dark brown loam or silt loam about 28 inches thick. The underlying layer is dark brown silt loam to depth of 60 inches or more. This soil is moderately calcareous and mildly alkaline in the surface layer and moderately alkaline in the underlying layer. It is dominantly loam, silt loam, or light clay loam stratified with fine sandy loam, clay loam, or silty clay loam. Faint mottles occur at a depth of about 28 inches. The depth to the seasonal high water table ranges from 25 to 36 inches. Surface flooding from nearby streams is rare and occurs during the spring periods of rapid snowmelt.

Permeability is moderate. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Hay, pasture, corn for silage, and small grains are the dominant crops.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and tillage help control erosion and maintain or improve crop production. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Border irrigation is used on alfalfa, small grains, and pasture. Land leveling is necessary in some areas to obtain an even distribution of irrigation water. Irrigation applications, length of runs, and intervals need to be adjusted to the water intake rate and available water capacity of the soil and to crop needs. Stream size should not cause soil movement in furrows, corrugations, and borders. Length of runs should be adjusted so that water reaches the end of field without overirrigating the upper portion. These practices help control erosion and reduce leaching of plant nutrients. Pipe, ditch lining, or drop structures should be used to help prevent excessive ditch erosion.

This soil has potential for providing food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye can be planted along fence rows and ditchbanks and in odd corners to help improve wildlife habitats. Food should be close to cover that will protect the birds from predators and inclement weather.

This soil has good potential for homesites and other types of urban development and is being rapidly converted to this use. The depth to the water table, low load supporting strength, and susceptibility to frost action are features that limit use for urban or recreational develop-

ments. Grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption fields will develop problems in some areas because of surface water flooding, or flooding from nearby streams. Contamination of ground water is a hazard where cesspools are used.

Recreational uses of this soil are mainly hunting and snowmobiling. A small area in Morgan County is being used for a golf course and recreation complex development. Capability unit IIc-2, irrigated.

EcA—Eastcan loam, cool, 0 to 3 percent slopes. This Eastcan soil is very deep and moderately well drained. It occurs on nearly level and gently sloping flood plains, valley bottoms, and stream terraces at elevations of 5,150 to 5,800 feet. This soil formed in alluvium from weathered quartzite, sandstone, and limestone. The slopes are short or medium in length. The average annual precipitation is about 18 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Utaba cobbly loam, Pringle loam, Canburn silt loam, and Broadhead clay loam, 2 to 5 percent slopes.

In a typical profile, the surface layer is very dark grayish brown loam in the upper part and light clay loam in the lower part and is about 29 inches thick. The underlying layer is dark yellowish brown or dark brown stratified clay loam or sandy loam. This soil is moderately calcareous and strongly alkaline. Rock fragment content is about 2 percent in the surface layer and underlying layer. Commonly, mottles occur below a depth of about 19 inches. The depth to the seasonal high water table varies from about 25 to 36 inches. This soil is dominantly loam, silt loam, or clay loam stratified with fine sandy loam, clay loam, or silty clay loam. Surface flooding from nearby streams is rare and occurs in late winter or early spring during periods of rapid snowmelt.

Permeability is moderate. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Hay, pasture, and small grains are the dominant crops.

A suitable crop rotation is 6 to 8 years of alfalfa or pasture and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help control erosion and maintain or improve crop production. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizer. Border, corrugation, and sprinkler irrigation methods are suitable for this soil. The method is generally governed by the crop. Sprinkler irrigation is well suited to most crops. Corrugation and border methods are suited to alfalfa, small grains, and pasture. Land leveling is necessary in some areas to obtain an even distribution of irrigation water. Irrigation applications, length of runs, and irrigation intervals should be adjusted to the water intake rate and available water capacity and to the crop needs. Irrigation streams should not cause soil movement in furrows, corrugations, or borders. Length of runs should be adjusted so that water reaches the end of the field without overirrigating the upper portion. These practices will help control erosion and leaching of plant nutrients. Irrigation ditch laterals that are subject to erosion should be protected by ditch lining, pipe, or drop structures.

This soil has potential for providing food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye can be planted along fence rows and ditchbanks and in odd corners to improve wildlife habitat. These plants provide shelter and protect the birds from predators and inclement weather and should be close to the food supply.

The depth to the water table, low load supporting strength, and susceptibility to frost action are features that limit the use of this soil for urban or recreational developments. Grasses, shrubs, and trees for beautification grow well in this soil. Careful selection of species is necessary. Septic tank absorption field problems will develop in some areas because of surface flooding from nearby streams. Contamination of ground water is a hazard where cesspools are used.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit IIIc-3, irrigated.

EdC—Eastcan variant loam, 6 to 10 percent slopes. This Eastcan variant soil is very deep and well drained. It occurs on strongly sloping alluvial fans and mountain foot slopes at elevations of 4,900 to 5,200 feet. This soil formed in alluvium weathered from quartzite, sandstone, and limestone. The slopes are short or medium in length. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost free season is about 105 days.

Included with this soil in mapping are small areas of Nebeker clay loam, 0 to 3 percent slopes, Parleys loam, high rainfall, 0 to 3 percent slopes, and a very deep, well drained, very gravelly soil that has slopes of 3 to 15 percent.

In a typical profile, the surface layer is very dark brown loam in the upper part and gravelly loam or gravelly clay loam in the lower part and is about 16 inches thick. The underlying layer is very dark brown, very dark grayish brown, or dark grayish brown gravelly clay loam or gravelly sandy clay loam to a depth of 60 inches or more. This soil is slightly calcareous and mildly alkaline except the lower part, which is moderately alkaline and moderately calcareous. Rock fragment content is about 10 percent in the upper part of the surface layer, 45 percent in the lower part of the surface layer, and 35 percent in the underlying layer. This soil is highly stratified in texture and ranges from clay loam to sandy loam.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more.

The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. The principal crops grown are alfalfa, pasture, and small grains.

A suitable crop rotation is 6 to 8 years of alfalfa or pasture and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are recommended to help reduce erosion and maintain favorable crop production. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizers, and usually legumes respond readily to phosphate fertilizer. The most efficient and desirable method of irrigation is by sprinklers. Sprinkler irrigation is well suited to most crops. Corrugation or border irrigation can be used but requires careful supervision. Regardless of the irrigation method used, water should be applied carefully to avoid erosion. Irrigation applications should be adjusted to the water intake rate and available water capacity and to crop needs to avoid overirrigation and leaching of plant nutrients. Irrigation distribution ditches subject to excessive erosion should have pipe, ditch lining, or drops to facilitate irrigation and prevent erosion.

This soil has potential for growing plants that provide food and shelter for Hungarian partridge, mourning dove, chukar, cottontail rabbit, porcupine, and skunk. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye can be planted along fence rows and ditchbanks and in corners to improve the wildlife habitat. This cover is close grown and protects the wildlife from predators and inclement weather.

This soil has potential for use for homesites and other urban developments. Lawns, shrubs, and trees for beautification grow well if they are adapted to the climate. Septic tank absorption field problems will develop in places because of the moderately slow permeability of the soil. Seepage from cesspools is a hazard and may contaminate the groundwater supply.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability unit IIIc-2, irrigated.

EeC—Eastcan variant loam, cool, 6 to 10 percent slopes. This Eastcan variant soil is very deep and well drained. It occurs on alluvial fans at elevations of 5,100 to 5,800 feet. This soil formed in alluvium weathered from quartzite, sandstone, and limestone. The slopes are short in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Isbell loam, gravelly substratum, 6 to 15 percent slopes, Mondey clay loam, 8 to 15 percent slopes, and Richville gravelly loam, 30 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and gravelly loam in the lower part and is about 15 inches thick. The underlying layer is very dark brown or dark brown gravelly clay loam to a depth of 60 inches or more. The surface layer is slightly or moderately calcareous and moderately alkaline, and the underlying layer is strongly calcareous and moderately alkaline. Rock fragment content is about 15 percent in the surface layer and 25 percent in the underlying layer.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for irrigated and nonirrigated crops. Principal crops grown are alfalfa and small grains. If the soil is irrigated, a suitable crop rotation is 6 to 8 years of alfalfa or pasture and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control and minimum tillage help reduce erosion and maintain crop production. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Sprinkler irrigation systems are suitable for this soil because their controlled application helps reduce erosion and surface runoff. Irrigation applications should be adjusted to the water intake rate and available water capacity and to crop needs. These practices will help to avoid overirrigation and leaching of plant nutrients.

If this soil is not irrigated, mostly small grain is grown in a continuous cropping system. Winter wheat varieties produce higher yields than spring varieties. Some areas are planted to pubescent and intermediate wheatgrass or to ladak alfalfa for hay. This permanent cover will help reduce soil erosion and improve soil tilth. Nitrogen fertilizers is usually needed to produce good nonirrigated crop yields. Soil erosion can be reduced if fall grain is seeded early and stubble-mulch tillage is used. Terraces, diversions, and grassed waterways are needed in places. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. Tillage practices should be either on the contour or across the slope to slow the rate of runoff and to help reduce soil erosion in years when the snow melts rapidly.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, chukar, sage grouse, mourning dove, sharp-tailed grouse, cottontail and jackrabbit, porcupine, and coyote. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. They provide shelter close to food and protect the birds and animals from predators and inclement weather.

This soil has potential use for urban or recreational developments. Septic tank absorption field problems will develop in places because of the moderately slow permeability.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability units IIIe-3, irrigated, and IIIe-M, nonirrigated.

ErD—Ercan loam, 3 to 15 percent slopes. This Ercan soil is deep and well drained. It occurs on sloping, strongly sloping, or moderately steep, concave and

slightly convex side slopes on high mountains. Elevation ranges from 7,500 to 8,700 feet. This soil formed in materials weathered from sandstone. Slopes are short or medium in length. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 40 days.

Included with this soil in mapping are small areas of Ercan loam, 15 to 30 percent slopes, Herd cobbly clay loam, 3 to 15 percent slopes, Yeljack loam, 6 to 15 percent slopes, and Lucky Star silt loam, 15 to 30 percent slopes.

In a typical profile, the surface layer is very dark brown or dark brown loam about 18 inches thick. The subsurface layer is yellowish red fine sandy loam about 9 inches thick in the upper part. The lower part is mixed with the subsoil and is about 8 inches thick. The subsoil is red clay loam. Sandstone bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 47 to 56 inches. This soil is slightly acid or medium acid.

Permeability is moderately slow. Effective rooting depth is 47 to 56 inches. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high. This soil is a major source of sediment pollution in streams, ponds and reservoirs if it is disturbed and conservation practices are not applied.

This soil is used mainly for grazing, water supply, woodland, and wildlife habitat.

Potential vegetation is an overstory of quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding bromegrass, and some aspen peavine and sweet-anise. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is important in helping to maintain adequate plant cover and the desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition may delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitats for beaver.

This soil has potential for cabin sites and recreational development. The moderate ability to support a load affects its use for these purposes. This soil has moderately slow permeability and problems will develop with septic tank absorption fields in some places.

This soil is important for watershed. Adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. If serious plant cover deterioration occurs, some areas of this soil will be a major sediment producer.

Recreational uses are mainly hunting and snowmobiling. Capability unit VIe-H, nonirrigated.

ErE—Ercan loam, 15 to 30 percent slopes. This Ercan soil is very deep and well drained. It occurs on slightly convex and concave side slopes on high mountaintops. Elevation ranges from 7,500 to 8,700 feet. This soil formed in material weathered from sandstone. Slopes are medium or long in length. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 40 days.

Included with this soil in mapping are small areas of Ercan loam, 3 to 15 percent slopes, Yeljack loam, 6 to 15 percent slopes, Lucky Star silt loam, 15 to 30 percent slopes, and Herd cobbly clay loam, 3 to 15 percent slopes.

In a typical profile, the surface layer is dark brown or dark reddish brown loam about 31 inches thick. The subsurface layer is mixed with the subsoil and is reddish brown loam about 8 inches thick. The subsoil is red clay loam in the upper 13 inches thick. The lower part of the subsoil is gravelly clay loam to a depth of 60 inches or more. This soil is slightly acid or neutral. Rock fragment content is about 40 percent in the lower part of the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high. This soil is a major source of sediment pollution in streams, ponds, and reservoirs in some areas when it is disturbed and conservation practices are not applied.

This soil is used mainly for grazing, water supply, woodland, and wildlife habitat.

Potential vegetation is an overstory of quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding brome, nodding bluegrass and some aspen peavine and sweet-anise. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired vegetation composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition may delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitats for beaver.

This soil has potential for cabin sites and recreational developments. Steep slopes and the moderate ability to support a load are features that limit use for this purpose. Septic tank absorption field problems occur in places because of the moderately slow permeability of this soil.

This soil is important for water supply. Adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. In places where the plant cover has seriously deteriorated, this soil is a major sediment producer.

Recreational use of this soil is mainly hunting. Capability unit VIe-H, nonirrigated.

ErG—Ercan loam, 30 to 60 percent slopes. This Ercan soil is very deep and well drained. It occurs on very steep, north- and east-facing, concave and slightly convex high mountainsides. Elevation ranges from 6,000 to 7,500 feet. This soil formed in material weathered from sandstone. Slopes are medium and long in length. The average annual precipitation is about 35 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Lucky Star silt loam, 30 to 60 percent slopes, Toncana loam, 40 to 60 percent slopes, Norcan loam, 30 to 60 percent slopes, some Rock outcrop.

In a typical profile, the surface layer is very dark brown loam about 13 inches thick. The subsurface layer is reddish brown clay loam about 15 inches thick in the upper part, and the lower part is mixed with the subsoil and is about 10 inches thick. The subsoil is dark red clay loam to a depth of 60 inches or more. This soil is slightly acid or medium acid. Rock fragment content is about 5 percent in the subsurface layer and 10 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high. When it is disturbed and soil conservation practices are not applied, this soil is a major source of sediment pollution in streams, ponds, and reservoirs.

This soil is used mainly for grazing, water supply, woodland, and wildlife habitat.

Potential vegetation is an overstory of quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding brome, and some aspen peavine and sweet-anise. When changes occur in composition of the potential vegetation due to use by livestock, wildlife or other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired vegetation composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition may delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods of tree harvest can be used only with difficulty because of the slopes. High lead logging methods are more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitats for beaver.

Very steep slopes and inaccessibility are features of this soil that limit use for any urban or recreational developments.

This soil is important for watershed. Adequate plant cover must be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. This soil is a major sediment producer in places where the plant cover has seriously deteriorated.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, irrigated.

EtG—Etchen very cobbly loam, 25 to 50 percent slopes. This Etchen soil is moderately deep and well drained. It occurs on steep and very steep, south- and west-facing, smooth and convex mountainsides. The elevation ranges from 5,800 to 8,000 feet. This soil formed in material weathered from sandstone. Slopes are medium and long in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 80 days.

Included with this soil in mapping are small areas of Guilder loam, 15 to 30 percent slopes, Bullnel gravelly loam, 2 to 15 percent slopes, Ercan loam, 15 to 30 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark reddish brown or reddish brown very cobbly loam, or cobbly loam about 8 inches thick. The subsoil is yellowish red cobbly, or very cobbly sandy clay loam. Sandstone is at a depth of 34 inches. The depth to bedrock ranges from 21 to 38 inches. This soil is mildly alkaline and slightly or moderately calcareous in the surface layer. The subsoil and substratum are moderately alkaline and moderately or strongly calcareous. Rock fragments cover about 60 percent of the soil surface. Rock fragment content is about 40 percent in the surface layer, 50 percent in the subsoil, and 70 percent in the substratum.

Permeability is moderate or moderately slow. Effective rooting depth is 21 to 38 inches over the bedrock. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominately bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or

other disturbances certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Brush management is practical in areas where brush species have increased and are dominating the vegetation if there is a reasonable understory of desirable grasses and forbs.

This soil has potential for supporting plants that provide food and cover for mule deer and elk during the spring, summer, and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, jackrabbit, coyote, bobcat, weasel, porcupine, and badger.

Inaccessibility and steep slopes are features that limit the use of this soil for homesites and recreational developments.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

EVG—Etchen-Henhoit association, very steep. This association of Etchen and Henhoit soils occurs dominantly on very steep mountainsides at elevations of 5,400 to 7,700 feet. Etchen very cobbly loam, 50 to 70 percent slopes, makes up about 50 percent of the association. It occurs on south- and west-facing convex ridges and knolls. Slopes are short and medium in length. Henhoit gravelly loam, 30 to 60 percent slopes, makes up about 30 percent of the association. It occurs dominantly on north- and east-facing, smooth and concave mountainsides. Slopes are medium and long in length.

Included with these soils in mapping are small areas of Schuster loam, 30 to 60 percent slopes; Hoskin cobbly loam, 30 to 50 percent slopes; Etchen very cobbly loam, 25 to 50 percent slopes; Norcan loam, 30 to 60 percent slopes; and some Rock outcrop.

The Etchen soil is moderately deep and well drained. It formed in materials weathered from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 75 days.

In a typical profile, the surface layer is dark brown very cobbly loam about 4 inches thick. The subsoil is dark yellowish brown very gravelly clay loam about 9 inches thick. The substratum is dark reddish brown very cobbly loam about 8 inches thick. Bedrock is at a depth of about 21 inches. Depth to the bedrock ranges from 21 to 40 inches. This soil is neutral. Rock fragments cover about 60 percent of the soil surface. Rock fragment content is about 35 percent in the surface layer and about 65 percent in the subsoil and substratum.

Permeability is moderate or moderately slow above the bedrock. Effective rooting depth is restricted by bedrock at a depth of 21 to 40 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

Potential native vegetation is dominately bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease.

The Henhoit soil is very deep and well drained. It formed in materials weathered from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 75 days.

In a typical profile, the surface layer is dark reddish brown gravelly loam about 10 inches thick. The subsoil, 30 inches thick, and the substratum are dark red very gravelly clay loam to a depth of 60 inches or more. The surface layer and subsoil are medium acid to neutral. The substratum has a small amount of lime and is mildly alkaline. Rock fragment content is about 20 percent in the surface layer and 60 percent in the subsoil and substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is Nevada bluegrass, slender wheatgrass, birchleaf mountainmahogany, bluebunch wheatgrass, bearded wheatgrass, mountain brome, and some Gambel oak, arrowleaf balsamroot, and antelope bitterbrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or to other disturbances, certain plants decrease and other plants increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Where brush species dominate areas of this association and there is a reasonable understory of desirable grasses and forbs, brush management is practical.

The soils in this association are used for range, water supply, and wildlife habitat.

These soils have potential for supporting plants that provide food and cover for mule deer during the fall, winter, and spring. They are also potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, and badger. Streams in this association are potential habitats for beaver.

Inaccesibility and very steep slopes are features that limit the use of soils in this association for homesites and recreational developments.

These soils are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining their watershed potential.

Recreational use of these soils is mainly hunting. Capability units VIIe-M, nonirrigated, for Henhoit soil and VIIs-M, nonirrigated, for Etchen soil.

EXG—Etchen-Schuster association, very steep. This association of Etchen and Schuster soils occurs mainly on very steep mountainsides at elevations of 6,100 to 8,200 feet. The Etchen very cobbly loam, 50 to 70 percent

slopes makes up about 40 percent of the association. It occurs on south- and west-facing ridges and knolls. Slopes are short and medium in length. The Schuster loam, 30 to 60 percent slopes, makes up about 40 percent of the association. This soil occurs mainly on the north- and east-facing, smooth or concave side slopes. Slopes are medium and long. The Etchen soil occurs under grasses and shrubs, and the Schuster soil occurs mostly under vegetation dominated by Gambel oak.

Included with these soils in mapping are small areas of Henhoit gravelly loam, 30 to 60 percent slopes, St. Marys very stony loam, 40 to 60 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, and some Rock outcrop.

The Etchen soil in this association is moderately deep and well drained. It formed in materials weathered from a conglomerate of quartzite and sandstone. The average annual precipitation is about 25 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 75 days.

In a typical profile, the surface layer is dark reddish brown or dark red gravelly loam about 11 inches thick. The subsoil is red gravelly clay loam in the upper part and very cobbly sandy clay loam in the lower part and is about 15 inches thick. Bedrock occurs at a depth of 26 inches. Depth to bedrock ranges from 26 to 30 inches. This soil is slightly calcareous and mildly alkaline. Rock fragments cover about 55 percent of the surface. Rock fragment content is about 20 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderately slow above the bedrock. Effective rooting depth is restricted to 21 to 40 inches by bedrock. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominately bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, big sagebrush, antelope bitterbrush, and some arrowleaf balsamroot.

The Schuster soil in this association is very deep and well drained. It formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 25 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is dark brown loam about 16 inches thick. The subsurface layer is reddish brown very cobbly loam about 9 inches thick. The subsoil is dark red very cobbly clay loam in the upper part and yellowish red gravelly loam in the lower part to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 20 percent in the surface layer, 50 percent in the subsurface layer, and 50 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is bluebunch wheatgrass, bearded wheatgrass, mountain snowberry, serviceberry and Gambel oak.

The soils in this association are used for range, water supply, and wildlife habitat.

When changes occur in the composition of potential vegetation of the soils in this association due to use by livestock or wildlife or other disturbances, the certain plants increase and other plants decrease. Proper grazing is an important management practice in maintaining adequate plant cover and desired composition. Aerial spraying can be used for brush management where these soils have a reasonable understory of desirable forbs and grasses.

The Etchen and Schuster soils have potential for supporting plants that provide food and cover for mule deer during the summer and fall. They also are potential habitats for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, and badger. Streams in the areas are potential habitats for beaver.

The soils in this association are not presently used for homesites because of inaccessibility and very steep slopes.

These soils are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Capability units VIIe-M, nonirrigated, for Schuster soil and VIIs-M, nonirrigated, for Etchen soil.

FAB—Fluvaquentic Haploborolls-Fluventic Haploxerolls complex, 1 to 6 percent slopes. This complex of Fluvaquentic Haploborolls and Fluventic Haploxerolls occurs on gently sloping and sloping, undulating flood plains, stream terraces, and alluvial fans of canyons and drainageways in mountainous areas at elevations of 4,950 to 7,000 feet. The Fluvaquentic Haploborolls, 1 to 6 percent slopes, make up about 50 percent of the complex and occur on the flood plains and stream terraces adjacent to the streams. Slopes are medium or long. The Fluvaquentic Haploxerolls, 1 to 6 percent slopes, make up about 30 percent and occur in drainageways on the sides of alluvial fans. Slopes are convex and short in length.

Included with this complex in mapping are small areas of Cumulic Haploborolls, wet, Cumulic Haploxerolls, loamy, Moweba gravelly loam, 6 to 15 percent slopes, Lamondi stony loam, 3 to 15 percent slopes, Nicodemus gravelly loam, 0 to 3 percent slopes, and Utaba cobbly loam, warm.

These soils formed in materials weathered from sandstone, quartzite, schist, phyllite, argillite, and limestone. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 90 days.

The Fluvaquentic Haploborolls are on flood plains, have a water table that fluctuates, are mottled, are somewhat poorly drained, have variable surface texture, and are stratified. Their organic matter content decreases irregularly with increase in soil depth. No one profile is typical of these soils, but one of the more common ones has a surface layer that is very dark brown gravelly loam in the upper part and very cobbly loam in the lower part

and that is about 19 inches thick. The underlying layer is dark brown very cobbly loamy sand to a depth of 60 inches or more. These soils are slightly acid. Rock fragment content is about 25 percent in the upper part of the surface layer and 65 percent in the lower part. The rock fragment content is about 80 percent in the underlying layer. The seasonal high water table varies in depth from 18 to 42 inches and usually occurs during late winter and spring. These soils are highly stratified clay loam, loam, sandy loam, or sand with 35 to 80 percent rock fragments, mostly of cobble size. Flooding is frequent and occurs during late winter and spring.

Fluventic Haploxerolls are on flood plains and are subject to occasional flooding, but they are well drained. Organic matter content decreases irregularly with depth. The surface layer texture is variable, and the underlying layers are stratified. No one profile is typical of these soils, but one of the more common ones has a surface layer of dark brown loam about 18 inches thick. The underlying layer is dark yellowish brown gravelly loamy sand about 6 inches thick. This is underlain by a very dark grayish brown silt loam buried surface layer about 19 inches thick. The next underlying layer is dark brown gravelly loam to a depth of 60 inches or more. These soils are strongly calcareous and moderately alkaline. Rock fragment content is about 25 percent in the upper part of the underlying layer and about 45 percent below a depth of about 24 inches. These soils are highly stratified clay loam, loam, or sandy loam with 0 to 35 percent rock fragments, mostly of cobble size. In some small areas very gravelly sand occurs below a depth of 40 to 50 inches. Flooding by runoff and flooding from nearby streams occur occasionally during late winter and spring.

Permeability is variable in the soils in this complex, but mostly it is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high or high. Surface runoff is slow. Erosion hazard is high.

The soils in this complex are used for range.

Potential vegetation on the Fluvaquentic Haploborolls is blue wildrye, bearded wheatgrass, mountain brome, muttongrass, slender wheatgrass, narrowleaf cottonwood, willow, and some box elder and water birch. Potential vegetation on the Fluventic Haploxerolls is bluebunch wheatgrass, Nevada bluegrass, muttongrass, longtongue muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation on these soils due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice in maintaining adequate plant cover and desired composition. Seeding is feasible where the understory of desirable grasses and forbs has been destroyed. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Brush management is feasible in those areas which have excessive shrubs and a reasonable understory of desirable grasses and forbs.

This complex has potential for supporting plants that provide food and cover for mule deer, elk, and moose during all seasons of the year. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, coyote, weasel, and badger. The adjacent streams are potential habitat for beaver.

The hazard of frequent flooding limits the potential of these soils for urban or recreational developments. Problems with septic tank absorption fields are a hazard because of the flooding. Pollution of the water supply is also a hazard because these soils are adjacent to streams.

Recreational uses of these soils are mainly hunting, snowmobiling, and trailbike and horseback riding. Capability unit VIw-4, nonirrigated.

FcG—Flygare loam, 30 to 60 percent slopes. This Flygare soil is very deep and well drained. It occurs mainly on north-, east-, and west-facing, very steep high mountainsides at elevations of 6,500 to 8,500 feet. This soil formed in materials weathered from a conglomerate of quartzite and sandstone and some schist. The average annual precipitation is about 35 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Lucky Star silt loam, 30 to 60 percent slopes, Poleline stony loam, 40 to 70 percent slopes, and Nagitsy stony loam, 50 to 70 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and gravelly loam in the lower part and is about 20 inches thick. The subsurface layer is dark grayish brown cobbly loam about 16 inches thick. The subsoil is yellowish brown very gravelly clay loam 11 inches thick. The substratum is brown very gravelly sandy clay loam to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 20 percent in the surface layer, 45 percent in the subsurface layer, 60 percent in the subsoil, and 80 percent in the substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for grazing, woodland, wildlife habitat, and water supply.

Potential vegetation is an overstory of quaking aspen and understory of mountain brome, nodding bromegrass, blue wildrye, bearded wheatgrass, and some aspen peavine and sweet-anise. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, some plants increase and others decrease. Proper grazing is an important management practice for maintaining adequate plant cover and desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition delays quaking aspen regeneration but will not prevent the eventual develop-

ment of a fully stocked, normal stand of trees. Use of conventional methods of tree harvest is difficult because of the slope. High lead logging is practical because it is more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. The streams in the area are potential habitat for beaver.

This soil is not presently used for homesites because of inaccessibility and steep slopes.

This soil is important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

FdG—Foxol-Durfee complex, 30 to 70 percent slopes. This complex of Foxol and Durfee soils occurs dominantly on south- and west-facing mountainsides at elevations of 5,400 to 8,500 feet. The Foxol very cobbly loam, 40 to 70 percent slopes, makes up about 40 percent of the complex. It occurs on short and medium, convex side slopes and ridges. The Durfee stony loam, 30 to 70 percent slopes, makes up about 25 percent of the complex. It occurs on medium and long, smooth or concave mountainsides.

Included with this complex in mapping are small areas of Smarts loam, 40 to 60 percent slopes; Poleline stony loam, 40 to 70 percent slopes; Yeates Hollow very stony loam, 30 to 70 percent slopes; and some Rock outcrop.

The Foxol soil is shallow and somewhat excessively drained. It formed in materials weathered mostly from quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 75 days.

In a typical profile, the surface layer is dark brown very cobbly loam about 10 inches thick. The subsoil is dark brown very cobbly loam about 6 inches thick. Quartzite is at a depth of about 16 inches. The depth to bedrock ranges from 14 to 16 inches. This soil is slightly acid. Rock fragment content is about 50 percent in the surface layer and 70 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 14 to 16 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominated by bluebunch wheatgrass, muttongrass, Nevada bluegrass, longtongue muttongrass, birchleaf mountainmahogany, and some mountain snowberry and antelope bitterbrush.

The Durfee soil is very deep and well drained. It formed in materials weathered from sandstone, quartzite, and some schist. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 70 days.

In a typical profile the surface layer is dark brown stony loam in the upper part and reddish brown very gravelly loam in the lower part and is about 16 inches thick. The subsoil is dark reddish brown very gravelly clay loam in the upper part and yellowish red, red, or dark red very gravelly clay in the lower part to a depth of 60 inches or more. This soil is slightly acid. Rock fragments cover about 30 percent of the soil surface. Rock fragment content is about 65 percent in the surface layer and about 70 percent in the subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, basin wildrye, Nevada bluegrass, big sagebrush, antelope bitterbrush, and some Gambel oak.

The soils in this complex are used for range, water supply, and wildlife habitat.

When changes occur in the composition of the potential vegetation on these soils due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice needed to maintain good plant cover and desired composition. Brush management is practical in areas with excessive shrubs that have a reasonable understory of desirable grasses and forbs.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer and elk, primarily during fall, winter, and spring. It also is potential habitat for grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, red fox, and badger. Streams that run through the area are potential habitat for beaver.

Very steep slopes, high rock fragment content, and depth to bedrock in the Foxol soil are the most limiting features of these soils for urban or recreational developments. Problems with septic tank absorption fields will occur in places because of slow permeability.

These soils are important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Capability unit VIIs-M, nonirrigated.

FrG—Foxol-Rock outcrop complex, 40 to 70 percent slopes. This complex of Foxol soil and Rock outcrop occurs on very steep south-, west-, and east-facing mountainsides and canyon walls at elevatons of 6,000 to 8,500 feet. Slopes are short and medium in length. The Foxol very cobbly loam, 40 to 70 percent slopes, makes up about 60 percent of the complex and the Rock outcrop about 20 percent. The Rock outcrop is interspersed throughout the map unit as ledges and outcroppings of bare bedrock.
croppings of bare bedrock.

Included in this complex in mapping are small areas of Smarts loam, 40 to 60 percent slopes, and Durst gravelly loam, 40 to 70 percent slopes.

The Foxol soil is shallow and somewhat excessively drained. It formed in materials weathered from quartzite. The average annual precipitation is about 22 inches. Mean annual air temperature is about 44 degrees F, and the frost-free period is about 70 days.

In a typical profile, the surface layer is very dark grayish brown very cobbly loam about 9 inches thick. The subsoil is dark brown very cobbly loam about 5 inches thick. Fractured bedrock is at a depth of about 14 inches. Depth to the bedrock ranges from 14 to 18 inches. This soil is slightly acid. Rock fragment content is about 60 percent in the surface layer and 70 percent in the subsoil.

Permeability is moderate above the bedrock. Effective rooting depth is 14 to 18 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, antelope bitterbrush, big sagebrush, and some birchleaf mountain-mahogany and yellowbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and other plants decrease. Proper grazing is an important management practice for maintaining adequate plant cover and the desired composition. Brush management is feasible in areas where brush species have increased and there is a reasonable understory of desirable grasses and forbs.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, red fox, and badger.

Very steep slopes, depth to bedrock, rock fragment content, and inaccessibility limit this soil for urban or recreational developments.

The Rock outcrop is interspersed throughout the complex. It consists of bare fractured quartzite on very steep mountain slopes and canyon walls. It is more than 90 percent barren, but may support sparse amounts of bluebunch wheatgrass, muttongrass, curlleaf mountain-mahogany and some Douglas-fir in pockets and along cracks.

Recreational use of this complex is mostly hunting. Capability unit VIIs-M, nonirrigated.

GaG—Geertsen loam, 30 to 70 percent slopes. This Geertsen soil is deep and well drained. It occurs on very steep, north- and east-facing high mountainsides at elevations of 7,400 to 9,100 feet. This soil formed in materials weathered from limestone and shale. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 60 days.

Included with this soil in mapping are small areas of Caballo gravelly loam, 40 to 70 percent slopes, Condie gravelly loam, 30 to 60 percent slopes, Cristo loam, 40 to 60 percent slopes, and Wallsburg gravelly loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 8 inches thick. The upper part of the subsoil is dark brown clay loam about 3 inches thick. The lower part of the subsoil is yellowish brown very cobbly clay loam about 34 inches thick. Limestone is at a depth of 45 inches. The depth to bedrock ranges from 40 to more than 60 inches. This soil is neutral. Rock fragment content is about 65 percent in the subsoil. The bedrock is highly fractured and has subsoillike materials in the fractures and cracks.

Permeability is moderately slow. Effective rooting depth is 40 to 60 inches or more. The available water capacity is moderately low or moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for woodland, wildlife habitat, and water supply.

Potential vegetation is Douglas-fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 1,960 cubic feet or 7,800 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions on timber production are slope and high content of rock fragments. Expected seedling mortality is between 25 and 50 percent. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition delays natural or artificial regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods of tree harvest should be restricted due to excessive slope. High lead logging methods are more efficient and less damaging to the soil surface.

Because of inaccessibility, steep slopes, and high rock fragment content, these soils are not used for urban or recreational developments.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat. The streams through the area are potential habitat for beaver.

This soil is important for water supply. Any recreational development or cabin sites should be carefully planned and its impact on the watershed environment fully evaluated. Careful management of timber resources and understory vegetation is necessary to keep soil losses to a minimum, thus maintaining the watershed potential. Provisions should be made to safeguard the trees from harmful insects and fire.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

GcG—Geertsen-Agassiz complex, 30 to 70 percent slopes. This complex of Geertsen and Agassiz soils occurs dominantly on very steep mountainsides and canyon walls at elevations of 6,000 to 8,300 feet. The Geertsen loam, 30 to 70 percent slopes, makes up about 70 percent of the complex. It occurs on north-facing, medium and long, concave slopes, mostly under vegetation dominated by conifers. The Agassiz stony silt loam, 40 to 70 percent slopes, makes up about 20 percent of the complex. It oc-

curs on ridges and south- and west-facing, short and medium, convex slopes, mostly under a cover of grasses, forbs, and shrubs.

Included with the complex in mapping are small areas of Rock outcrop interspersed throughout the map unit as ledges and outcroppings of bare bedrock and small areas of Lithic Haploxerolls.

These soils formed in materials weathered mostly from limestone. The average annual precipitation is about 30 inches, and the average frost-free season is about 60 days. The mean annual air temperature is about 41 degrees F for the Geertsen soil and 44 degrees F for the Agassiz soil.

The Geertsen soil is deep and well-drained. In a typical profile, the surface layer is black loam about 10 inches thick. The subsoil is dark brown clay loam and gravelly clay loam about 18 inches thick. The substratum is dark brown very gravelly loam. Highly fractured limestone is at a depth of about 48 inches. The depth to the bedrock varies from 40 to 60 inches or more. The surface layer is neutral. The upper part of the subsoil is slightly acid and the lower part is slightly calcareous and neutral. The substratum is slightly calcareous and mildly alkaline. Rock fragment content is about 15 percent in the upper part of the subsoil, 45 percent in the lower part of the subsoil, and 65 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 40 to 60 inches or more. The available water capacity is moderately low or moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for woodland, wildlife habitat, and water supply.

Potential vegetation is Douglas fir, white fir, alpine fir, pinegrass, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 1,960 cubic feet or 7,800 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope and high content of rock fragments. Expected mortality of naturally occurring or planted tree seedlings is between 25 and 50 percent. Care must be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition delays natural or artificial regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Use of conventional methods of tree harvest should be restricted due to excessive slope. High lead logging methods are more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, showshoe hare, porcupine, red fox, coyote, weasel, and bobcat. The streams through the area are potential habitat for beaver.

This soil is important for watershed. Any recreational development of cabin sites should be carefully planned and its impact on the environment fully evaluated. Careful management of timber resources and understory is necessary to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

This Agassiz soil is shallow and somewhat excessively drained. In a typical profile, the surface layer is dark brown stony or very cobbly silt loam about 8 inches thick. The underlying layer is brown very cobbly silt loam 6 inches thick. Limestone is at a depth of about 14 inches. The depth to bedrock varies from 14 to 19 inches. Rock fragment content is about 55 percent in the surface layer and 70 percent in the underlying layer. The surface layer is slightly acid, and the underlying layer is neutral.

Permeability is moderate above the bedrock. Effective rooting depth is 14 to 19 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, watershed, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, and antelope bitterbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter, spring, and fall. It also is potential habitat for ruffed grouse, blue grouse, coyote, bobcat, weasel, badger, and porcupine. Streams through the area are potential habitat for beaver.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining their watershed potential.

The inaccessibility, very steep slopes, shallow depth to bedrock, and high rock fragment content are soil features that restrict urban or recreational developments on the soils in this complex.

Recreational use of this complex is hunting. Capability unit VIIe-H, nonirrigated.

GeE—Guilder loam, 15 to 30 percent slopes. This Guilder soil is deep and well drained. It occurs on moderately steep and steep, north-facing, concave mountainsides at elevations of 7,200 to 8,000 feet. Slopes are medium and long in length. This soil formed in materials weathered from sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Bullnel gravelly loam, 30 to 50 percent slopes, Bullnel gravelly loam, 2 to 15 percent slopes, eroded, Etchen very cobbly loam, 25 to 50 percent slopes, and Ercan loam, 15 to 30 percent slopes.

In a typical profile, the surface layer is dark reddish brown loam in the upper part and clay loam in the lower part and is about 12 inches thick. The upper part of the subsoil is dark red clay loam and silty clay loam and is about 19 inches thick. The lower part of the subsoil is reddish brown, dark red, or red silty clay loam, clay loam, or loam. Weathered sandstone is at a depth of 65 inches or more. The surface layer and the upper part of the subsoil are neutral. The lower part of the subsoil has lime accumulations and is moderately alkaline. Rock fragment content is about 20 percent in the lower subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush and mountain snowberry. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Brush management has potential in areas that have excessive shrubs and a reasonable understory of desirable grasses and forbs. Range seeding potential is good in areas of severely deteriorated range vegetation. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, red fox, weasel, and badger.

This soil is not presently used for homesites because of inaccessibility. The moderately steep and steep slopes are the most limiting features of this soil for urban or recreational developments. Septic tank absorption fields develop problems in some areas because of slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. Where plant cover is seriously deteriorated and this soil is disturbed, it is a major source of sediment in streams and ponds.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

HaC—Hades loam, 6 to 15 percent slopes. This Hades soil is very deep and well drained. It occurs on benches, alluvial fans, and stream terraces in mountainous areas at elevations of 6,000 to 7,600 feet. The slopes are short or medium in length. This soil formed in alluvium from mixed sedimentary rocks, dominantly sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Moweba gravelly loam, 6 to 15 percent slopes, Isbell loam, gravelly substratum, 6 to 15 percent slopes, Cumulic Haploborolls, wet, Cumulic Haploxerolls, loamy, and Croydon loam, 30 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown or very dark grayish brown loam about 24 inches thick. The subsoil is a dark brown loam in the upper part and dark yellowish brown clay loam to a depth of 72 inches or more. This soil is medium acid to neutral in the surface layer and subsoil. The substratum has a moderate amount of lime and is moderately alkaline. The substratum occurs at a depth below 54 to 60 inches or more. The substratum has about 50 percent rock fragments.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Brush management has potential in areas with excessive brush and a reasonable understory of desirable grasses and forbs. Range seeding is advisable if the plant composition is severely deteriorated. Species suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Successful seedings depend on proper seedbed preparation, depth of seeding, and time of seeding.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments. The high amount of organic matter extending deep into the soil causes a problem in places for building foundations. Septic tank absorption field problems will develop in places because of moderately slow permeability.

This soil is important for water supply. Adequate plant cover must be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

HaG—Hades loam, 40 to 60 percent slopes. This Hades soil is very deep and well drained. It occurs on

smooth or concave, north-facing, very steep mountainsides at elevations of 5,600 to 7,600 feet. The slopes are medium and long in length. This soil formed in material weathered from sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Isbell loam, 40 to 60 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, Moweba gravelly loam, 30 to 50 percent slopes, Croydon loam, 30 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown or very dark grayish brown loam about 24 inches thick. The subsoil is dark brown loam in the upper part and dark yellowish brown clay loam in the lower part to a depth of 72 inches or more. This soil is medium acid.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain species increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical where brush species are excessive and a reasonable understory of desirable grasses and forbs are present. Range seeding has potential in severely deteriorated areas. Species suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitat for beaver.

The very steep slopes and relative inaccessibility of this soil limit its use for urban and recreational developments. Septic tank absorption field problems will develop in some areas because of the moderately slow permeability.

This soil is important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

HbC—Hawkins silty clay, 3 to 6 percent slopes. This soil is very deep and well drained. It occurs on rolling foothills and alluvial fans at elevations of 4,850 to 5,300 feet. This soil formed in materials mostly weathered from tuffaceous sandstone. The slopes are short to medium in length. The average annual precipitation is about 18 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Nebeker clay loam, 0 to 3 percent slopes, Mondey clay loam, 8 to 15 percent slopes, Manila loam, 0 to 3 percent slopes, and Cumulic Haploborolls, wet.

In a typical profile, the surface layer is very dark brown silty clay about 7 inches thick. The subsoil is very dark brown silty clay about 30 inches thick. The substratum is pale brown or light brownish gray loam or sandy loam to a depth of 60 inches or more. The surface layer and subsoil are neutral. The substratum is strongly or moderately calcareous and strongly alkaline. This soil has a high shrink-swell potential. The surface layer is mixed with the underlying layers to a depth of about 37 inches.

Permeability is slow. Intake rate is slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated and nonirrigated crops. Principal crops grown under irrigation are alfalfa and small grains.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture and 2 to 3 years of small grain. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help reduce erosion, maintain favorable tilth, and maintain or improve water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Sprinkler irrigation is well suited to this soil because the control of water applications reduces soil erosion and surface water runoff. Most climatically adapted crops grow well. Regardless of the irrigation method used, water should be carefully applied to avoid erosion on the steeper slopes. Care should be taken to avoid overirrigation and leaching of soil nutrients. Pipe or ditch lining should be installed in distribution ditches to facilitate irrigation and prevent excessive ditch erosion.

When this soil is used for nonirrigated crops, mostly small grain is grown in a continuous cropping system. This soil is well suited to winter wheat. Yields of winter wheat are higher than yields of spring wheat varieties. Some areas are planted to pubescent or intermediate wheatgrass or alfalfa for hay or pasture. These plantings help to control erosion and improve tilth. Nitrogen should be applied to meet plant needs. Applications should be in agreement with the latest State experiment station recommendations. Soil erosion can be reduced if fall grain is seeded early and stubble-mulch tillage is used. Terraces, diversions, and grassed waterways are needed in places and should be installed. Drop structures are needed in a few places to stablize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope. These practices slow down

the rate of runoff and reduce soil erosion during periods of rapid snowmelt.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, some ringneck pheasant, and porcupine. Such plants as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the cover and habitat for wildlife. Food should be close to shelter that protects the birds from predators and inclement weather.

Some areas of this soil are used for homesites and other urban developments. The limited ability to support a load and the high shrink-swell potential are soil features that limit use for urban or recreational developments. Dwellings and roads can be designed to offset these soil limitations. Septic tank absorption field problems will develop in some areas because of slow permeability.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability unit IIIe-3, irrigated, and IIIe-M, nonirrigated.

HbD—Hawkins silty clay, 6 to 15 percent slopes. This strongly sloping Hawkins soil is very deep and well drained. It occurs on all aspects in concave and convex areas on rolling hills, foothills, and alluvial fans. Slopes are short and medium. Elevation ranges from 5,150 to 6,600 feet. This soil formed in materials weathered mostly from tuffaceous sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Hawkins silty clay, 15 to 30 percent slopes, Manila loam, 10 to 25 percent slopes, and Yeates Hollow cobbly loam, 6 to 10 percent slopes. Also included are areas of soils that have a cobbly or very cobbly loam surface layer.

In a typical profile, the surface layer is very dark grayish brown silty clay about 8 inches thick. The subsoil is dark brown clay about 23 inches thick. The substratum is yellowish brown clay, clay loam, or loam to a depth of 60 inches or more. The surface layer and subsoil are slightly acid. The substratum is moderately or strongly calcareous and mildly alkaline. This soil has a high shrink-swell potential. The surface layer is mixed with the underlying layers to a depth of about 41 inches.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used for nonirrigated crops, range, water supply, and wildlife habitat. When this soil is used for nonirrigated crops, winter wheat and spring barley are the principal crops.

Soil erosion on nonirrigated cropland is a hazard because of the strongly sloping and moderately steep slopes. When cultivated, this soil should be in permanent cover about 75 percent of the time. Alfalfa and intermediate wheatgrass are suitable species for hay and pasture. Nitrogen and phosphate fertilizers should be applied to meet plant needs. Applications should be in agreement with the latest state experiment station recommendations. Soil erosion on cultivated areas can be reduced if fall grain is seeded early and stubble mulch-tillage is used. Terraces, diversions, and grassed waterways should be installed if needed to help control soil erosion. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope. Such practices help slow down the rate of runoff and reduce soil erosion during periods of rapid snowmelt.

Potential vegetation is dominantly bluebunch wheatgrass, prairie junegrass, Idaho fescue, slender wheatgrass, Letterman needlegrass, and some lupine and antelope bitterbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Brush management is practical in areas with excessive shrubs and a reasonable understory of desirable grasses or forbs. Proper grazing is an important management practice in helping to maintain adequate plant cover and in obtaining the desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, fall, and summer. It also is potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, badger, porcupine, and red fox.

This soil has potential for urban and recreational developments. Dwellings and roads can be designed to offset the high shrink-swell potential and limited ability to support a load. Care should be taken in disturbing the soil on the steep slopes because of the susceptibility to hillside slippage. Septic tank absorption field problems will develop in places because of slow permeability. Vegetative slip scars and deep active gullies occur throughout areas of this soil.

Recreational use is mainly hunting and snowmobiling. Capability unit IVe-M, nonirrigated.

HbE—Hawkins silty clay, 15 to 30 percent slopes. This Hawkins soil is very deep and well drained. It occurs on concave to convex, moderately steep and steep rolling hills, foothills, and alluvial fans on all aspects. Elevation ranges from 5,200 to 6,000 feet. The slopes are short or medium in length. This soil formed in materials weathered mostly from tuffaceous sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 85 days.

Included with this soil in mapping are small areas of Hawkins silty clay, 6 to 15 percent slopes, Ostler loam, 20 to 50 percent slopes, Causey silt loam, 30 to 60 percent slopes, Choptie silt loam, 30 to 60 percent slopes, and soils with a cobbly or very cobbly loam surface layer.

In a typical profile, the surface layer is very dark grayish brown silty clay about 2 inches thick. The subsoil is very dark grayish brown or dark grayish brown silty clay about 36 inches thick. The substratum is brown or grayish

brown clay loam to a depth of 74 inches or more. The surface layer and subsoil are slightly acid. The substratum is moderately calcareous and moderately or strongly alkaline. This soil has a high shrink-swell potential. The surface layer is mixed with the underlying layers to a depth of about 38 inches.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, watershed, and wildlife habitat.

Potential vegetation is dominantly slender wheatgrass, Letterman needlegrass, bluebunch wheatgrass, prairie junegrass, Idaho fescue, and some Columbia needlegrass, lupine, and antelope bitterbrush. When changes occur in the composition of the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and in obtaining the desired composition. Brush management is practical in areas of excessive brush with a reasonable understory of desirable grasses or forbs.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, fall, and summer. It also is potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitat for beaver.

This soil has potential for urban and recreational developments. Dwellings and roads should be designed to offset the high shrink-swell potential and the limited ability to support a load. High shrink-swell potential can cause damage to buildings and road foundations. Care should be taken in disturbing the soil on the steep slopes because of the susceptibility to hillside slippage. Septic tank absorption field problems will develop in some areas because of slow permeability. Vegetative slip scars and deep active gullies occur throughout this soil.

Recreational uses of this soil are mainly hunting, snowmobiling, and camping. Capability unit VIe-M, nonirrigated.

HcE—Hawkins-Collinston complex, 6 to 30 percent slopes. This complex of Hawkins and Collinston soils occurs generally on rolling hills and foothills at elevations of 5,000 to 5,150 feet. The Hawkins silty clay, 6 to 15 percent slopes makes up about 50 percent of the complex. It occurs dominantly on north- and east-facing, concave, medium and long, strongly sloping and moderately steep side slopes. The Collinston silt loam, 15 to 30 percent slopes makes up about 40 percent of the complex. It occurs dominantly on the south- and west-facing, moderately steep and steep, convex ridges and knolls.

Included with this complex in mapping are small areas of Hawkins silty clay, 15 to 30 percent slopes, Choptie silt loam, 30 to 60 percent slopes, and Causey silt loam, 30 to 60 percent slopes.

Both Hawkins and Collinston soils are very deep and well drained. They formed in materials weathered from tuffaceous sandstone and tuffaceous siltstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 100 days.

In a typical profile of the Hawkins soil, the surface layer is very dark brown silty clay about 13 inches thick. The subsoil and substratum are brown heavy silty clay loam to a depth of 60 inches or more. This soil is slightly acid. It has a high shrink-swell potential. The surface layer has been mixed with the subsoil to a depth of about 48 inches.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high or moderately high. Surface runoff is medium. Erosion hazard is high.

In a typical profile of the Collinston soil, the surface layer is very dark grayish brown silt loam about 9 inches thick. The underlying layer is pale olive or light gray silty clay loam or silt loam to a depth of 60 inches or more. This soil is strongly calcareous and moderately or strongly alkaline throughout.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

The soils are used for nonirrigated crops. Principal crops are winter wheat and spring barley.

Soil erosion is a serious problem and these soils should be planted to permanent cover. Species suitable for seeding are intermediate wheatgrass, Regar brome, smooth brome, orchardgrass, and alfalfa. Proper grazing is an important management practice in maintaining adequate plant cover. Fertilizer should be applied to meet plant needs and should be in agreement with the latest State experiment station recommendations. Alfalfa responds readily to phosphate fertilizer.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the spring. They also are potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, badger, and porcupine.

Some areas of this complex are being used for homesites. The Hawkins soil has high shrink-swell potential and limited ability to support a load. Dwellings and roads can be designed to offset these soil features. Care should be taken in disturbing the Hawkins soil on the steep slopes because of susceptibility to hillside slippage. Septic tank absorption fields on the Hawkins soil will develop problems in some areas because of slow permeability.

Recreational uses of these soils are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

HeD—Henefer loam, 6 to 15 percent slopes. This Henefer soil is very deep and well drained. It occurs on alluvial fans, foothills, and stream terraces at elevations of 5,400 to 6,600 feet. This soil formed in alluvium mostly weathered from a conglomerate of sandstone and

quartzite. The slopes are short or medium in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Manila loam, 6 to 10 percent slopes, Manila loam, 10 to 25 percent slopes, Yeates Hollow very stony loam, 10 to 30 percent slopes, Yeates Hollow cobbly loam, 6 to 10 percent slopes, and Moweba gravelly loam, 6 to 15 percent slopes.

In a typical profile, the surface layer is very dark grayish brown loam about 15 inches thick. The subsoil is dark brown clay loam in the upper part and reddish brown cobbly heavy clay loam or gravelly heavy clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is 5 percent in the surface layer, 20 percent in the upper part of the subsoil, and 30 percent in the lower part.

Permeabiity is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, bearded wheatgrass, bigtooth maple, mountain snowberry, Utah snowberry, and some arrowleaf balsamroot, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and for obtaining the desired composition. Brush management is practical in areas with excess shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is advisable if the plant composition shows severe deterioration. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Successful range seedings depend on seedbed preparation, depth of seeding, and time of seeding.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments, but in some areas septic tank absorption fields will develop problems because of slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of the soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

HeG—Henefer loam, 40 to 60 percent slopes. This Henefer soil is very deep and well drained. It occurs on smooth or concave, north- or east-facing, very steep mountainsides at elevations of 5,200 to 7,400 feet. The slopes are medium and long in length. This soil formed in materials mostly weathered from a conglomerate of sandstone and quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Yeates Hollow very stony loam, 30 to 70 percent slopes, Moweba gravelly loam, 30 to 50 percent slopes, and St. Marys cobbly loam, 30 to 50 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 16 inches thick. The subsoil is dark brown gravelly silty clay loam or reddish brown very gravelly silty clay in the upper part and reddish brown very cobbly silty clay in the lower part to a depth of 60 inches or more. This soil is neutral. Rock fragment content is about 10 percent in the surface layer, 25 percent in the upper part of the subsoil, and 65 percent in the lower part of the subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is Gambel oak, bluebunch wheatgrass, bigtooth maple, mountain snowberry, serviceberry, Utah snowberry, and some basin wildrye, muttongrass, antelope bitterbrush, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and the desired composition. Brush management is practical in areas of excessive shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is advisable if the plant composition shows severe deterioration. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitats for beaver.

The very steep slopes and relative inaccessibility of this soil are features that limit its use for urban and recreational development. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken when disturbing the soil on steep slopes because of susceptibility to hillside slippage. Septic tank absorption field problems will develop in some areas because of slow permeability.

This soil is important for watershed. Adequate plant cover should be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

HpG—Henhoit gravelly loam, 30 to 60 percent slopes. This Henhoit soil is very deep and well drained. It occurs dominantly on east-, south- and west-facing, very steep mountainsides at elevations of 5,200 to 7,500 feet. This soil formed in materials weathered from quartzite and sandstone conglomerate. It is located mainly south of the Weber River between Morgan and Devils Slide, south of East Canyon Reservoir, and in the drainageways of Hardscrabble Creek in Morgan County. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 75 days. The slopes are medium and long in length.

Included with this soil in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, St. Marys very stony loam, 40 to 70 percent slopes, Toncana loam, 40 to 60 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, and Etchen very cobbly loam, 50 to 70 percent slopes.

In a typical profile, the surface layer is dark reddish brown gravelly loam about 10 inches thick. The subsoil is dark red very gravelly clay loam to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 20 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bearded wheatgrass, bluebunch wheatgrass, mountain brome, Nevada bluegrass, slender wheatgrass, birchleaf mountainmahogany, Gambel oak, and some arrowleaf balsamroot and antelope bitterbrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain species increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and obtaining the desired composition. Brush management is practical in areas of excessive shrubs that have a reasonable understory of desirable grasses and forbs.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitat for beaver.

The very steep slopes and inaccessibility are features that limit the potential for urban and recreational developments. Septic tank absorption field problems develop in some areas because of slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

HrC—Herd cobbly clay loam, 3 to 15 percent slopes. This Herd soil is deep and well drained. It occurs on rolling high mountaintops and ridges at elevations of 7,500 to 8,300 feet. This soil formed in till from a conglomerate of sandstone and quartzite over materials weathered from sandstone. The slopes range from short to long in length. The average annual precipitation is about 30 inches, mean annual air temperature is about 40 degrees F, and the frost-free season is about 60 days.

Included with this soil in mapping are small areas of Yence very stony loam, 3 to 15 percent slopes, Richens loam, 3 to 15 percent slopes, Yeljack loam, 6 to 15 percent slopes, Charcol gravelly fine sandy loam, 30 to 50 percent slopes, and Ercan loam, 3 to 15 percent slopes.

In a typical profile, the surface layer is dark reddish brown cobbly loam about 17 inches thick. The upper part of the subsoil is red clay about 20 inches thick. The lower part of the subsoil is red clay loam about 6 inches thick. Sandstone bedrock is at a depth of about 43 inches. Depth to bedrock ranges from 40 to more than 60 inches. This soil is medium or slightly acid. Rock fragment content is about 25 percent in the surface layer only.

Permeability is slow. Effective rooting depth is 40 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is mountain brome, slender wheatgrass, mountain snowberry, and some bearded wheatgrass, mulesear dock, and antelope bitterbrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and for obtaining the desired composition. Brush management is practical in areas of excessive shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is advisable in areas where the vegetation has seriously deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, red fox, porcupine, coyote, bobcat, weasel, and badger.

The areas of this soil are mostly inaccessible. The limited ability to support a load and the high amount of rock fragments in the surface layer are features that limit future uses of this soil. Septic tank absorption fields will develop problems in some areas because of slow permeability.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-H, nonirrigated.

HtC—Herd-Yence complex, 3 to 15 percent slopes. This complex of Herd and Yence soils occurs dominantly

on south- and west-facing undulating and rolling high mountaintops at elevations of 7,000 to 9,000 feet (fig. 6). Slopes range from 3 to 25 percent, but are dominantly 3 to 15 percent. The Herd cobbly clay loam, 3 to 15 percent slopes, makes up about 40 percent of the complex. It occurs on medium or long, even or slightly concave slopes. The Yence extremely stony loam, 3 to 15 percent slopes, makes up about 35 percent of the complex. It occurs on short and medium, convex slopes and ridges.

Included with this complex in mapping are small areas of Richens loam, 3 to 15 percent slopes, and Yeljack loam, 6 to 15 percent slopes.

The average annual precipitation for the soils in this complex is about 30 inches. The mean annual air temperature is about 41 degrees F, and the frost-free season is about 60 days.

The Herd soil is very deep and well drained. It formed in glacial till from a conglomerate of sandstone and quartzite over material weathered from sandstone.

In a typical profile, the surface layer is very dark brown or brown cobbly clay loam about 20 inches thick. The subsoil is yellowish red clay in the upper 16 inches and red clay loam in the lower 14 inches. The substratum is red gravelly clay loam to a depth of 70 inches or more. This soil is slightly acid or medium acid in the surface layer and strongly acid in the subsoil and substratum. Rock fragment content is about 25 percent in the surface layer, 5 percent in the subsoil, and 40 percent in the substratum.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high.

The Yence soil is deep and well drained. It formed in glacial till materials from sandstone and quartzite.

In a typical profile, the surface layer is dark reddish brown extremely stony loam or very gravelly loam about 9 inches thick. The subsoil is dark red, red or yellowish red very gravelly or very cobbly heavy clay loam or cobbly clay about 33 inches thick. Sandstone bedrock is at a depth of 42 inches. The depth to bedrock ranges from 40 to 60 inches or more. The soil is slightly acid in the surface layer and medium or slightly acid in the subsoil. Rock fragment content is about 60 percent in the surface layer and subsoil.

Permeability is slow. Effective rooting depth is 40 inches or more. The available water capacity is low or moderately low. Surface runoff is slow. Erosion hazard is high.

The soils in this complex are used for range, water supply, and wildlife habitat.

Potential vegetation for the Herd soil is dominantly slender wheatgrass, mountain brome, mountain snowberry, and some bearded wheatgrass, Idaho fescue, lupine, and mulesear dock. The potential vegetation for the Yence soil is dominantly slender wheatgrass, mountain brome, mountain snowberry, and some bearded wheatgrass, lupine, mulesear dock, low sagebrush, and silver sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for maintaining good plant cover and desired composition. Brush management is practical where shrubs become excessive and there is a reasonable understory of desirable grasses and forbs. Range seeding is advisable in areas where the vegetation has seriously deteriorated. Grasses suitable for seeding are smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

These soils have potential for supporting plants that provide food for mule deer and elk, primarily during the summer and fall. They also are potential habitat for sage grouse, sharp-tailed grouse, cottontail rabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

These soils have not been used for urban or recreational development because of inaccessibility, high amount of rock fragment content in the surface layer and on the surface, and the inability to support a load. Septic tank filter fields develop problems in some areas because of slow permeability.

These soils are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of these soils are mainly hunting and snowmobiling. Capability unit VIIs-H, nonirrigated.

HuC—Holmes very stony loam, high rainfall, 3 to 10 percent slopes. This Holmes soil is very deep and well drained. It occurs on west- and north-facing sides of strongly sloping alluvial fans at elevations of 5,000 to 5,700 feet. This soil formed in alluvium weathered from quartzite and sandstone. The slopes are medium and short in length. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 90 days.

Included with this soil in mapping are small areas of Utaba cobbly loam and Yeates Hollow cobbly loam, 6 to 10 percent slopes.

In a typical profile, the surface layer is very dark grayish brown very stony loam in the upper part and cobbly loam in the lower part and is about 11 inches thick. The subsoil is dark brown very cobbly clay loam about 21 inches thick. The substratum is dark brown very gravelly sandy loam to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 45 percent in the surface layer and about 70 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, longtongue muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation com-

position due to use by livestock or wildlife or other disturbances, some plants increase and others decrease. Proper grazing is an important management practice in helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excess shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is advisable where the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, Hungarian partridge, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential for home sites, cabin sites, and recreational developments. The high content of rock fragment is the soil feature that limits use for urban developments. Pollution hazard to water supplies is a concern in some areas when this soil is used for septic tank filter fields.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining its water supply potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIIs-M, nonirrigated.

HvG—Horrocks-Rock outcrop complex, 40 to 70 percent slopes. This complex of Horrocks gravelly loam, 40 to 70 percent slopes, and Rock outcrop occurs on very steep, south- and west-facing mountainsides at elevations of 5,400 to 7,600 feet. The slopes are medium and long in length. The Horrocks soil makes up about 70 percent of the complex and the Rock outcrop makes up about 15 percent. The Rock outcrop is interspersed throughout the complex as ledges and outcrops of bare bedrock.

Included with this complex in mapping are small areas of Agassiz stony silt loam, 40 to 70 percent slopes, Burgi loam, 40 to 70 percent slopes, and Geertsen loam, 30 to 70 percent slopes.

The Horrocks soil is deep and well drained. It formed in materials weathered mostly from limestone. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free period is about 70 days.

In a typical profile, the surface layer is very dark brown gravelly loam in the upper part and very dark grayish brown cobbly loam in the lower part and is about 15 inches thick. The upper part of the subsoil is dark brown very cobbly clay loam about 22 inches thick. The lower part of the subsoil is dark brown gravelly clay loam about 8 inches thick. The substratum is weathered shale or limestone at a depth of 45 inches or more. Depth to weathered shale or limestone ranges from 45 to 55 inches. This soil is slightly acid in the surface layer and upper part of the subsoil. The lower part of the subsoil is slightly calcareous and is mildly alkaline. The weathered shale has accumulation of lime in places and is moderately alkaline. Rock fragment content is about 25 percent in the surface layer and 50 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 45 to 55 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range.

Potential vegetation is dominantly bearded wheatgrass, bluebunch wheatgrass, Nevada bluegrass, mountain brome, Gambel oak, birchleaf mountainmahogany, and some slender wheatgrass, arrowleaf balsamroot, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas where shrubs have increased and a reasonable understory of desirable grasses and forbs is present.

This soil has potential for supporting plants that provide food and cover for mule deer during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

The very steep slopes, high content of rock fragments and inaccessibility are features that limit the potential of this soil for urban or recreational developments.

The Rock outcrop is interspersed throughout the complex and consists of bare fractured limestone on very steep mountainsides and ridges. It is more than 90 percent barren, but may support sparse amounts of bluebunch wheatgrass, muttongrass, and curlleaf mountainmahogany or Douglas-fir in pockets and cracks.

These areas have esthetic value and are used with the Horrocks soil for wildlife habitat.

The present recreational use of this complex is mostly hunting. Capability unit VIIe-M, nonirrigated.

HwG—Hoskin cobbly loam, 30 to 50 percent slopes. This Hoskin soil is moderately deep and well drained. It occurs dominantly on south- and west-facing convex mountainsides at elevations of 5,300 to 7,000 feet. The slopes are medium and long in length. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the frost-free period is about 75 days.

Included with this soil in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, Moweba gravelly loam, 30 to 50 percent slopes, Yeates Hollow very stony loam, 30 to 70 percent slopes, Henhoit gravelly loam, 30 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark grayish brown or dark brown cobbly loam about 19 inches thick. The subsoil is dark brown, or red cobbly or very cobbly clay loam about 20 inches thick. Weathered sandstone is at a depth of 39 inches. The depth to bedrock ranges from 32 to 39 inches. This soil is neutral. Rock fragment content is about 45 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is about 32 to 39 inches. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, Idaho fescue, oniongrass, antelope bitterbrush, big sagebrush, prairie junegrass, and some arrowleaf balsamroot, mountain snowberry, and birchleaf mountainmahogany. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and to obtain the desired composition. Brush management is practical in areas with excessive shrubs that have a reasonable understory of desirable grasses and forbs.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail rabbit, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Inaccessibility, steep slopes, concentration of rock fragments, and moderate depth to bedrock are features that limit the potential of this soil for urban and recreational developments. Septic tank absorption field problems will develop in places because of the steep slopes and depth to bedrock.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

HxG—Hoskin-Rock outcrop complex, 50 to 70 percent slopes. This complex of Hoskin soil and Rock outcrop occurs on very steep, dominantly south- and west-facing mountainsides and canyon walls at elevations of 5,300 to 7,000 feet. The Hoskin cobbly loam, 50 to 70 percent slopes, makes up about 70 percent of the complex and the Rock outcrop makes up about 20 percent. The Rock outcrop is interspersed throughout the mapping unit as ledges and outcroppings of bare rock.

Included in this complex in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, and Moweba gravelly loam, 30 to 50 percent slopes.

The Hoskin soil is moderately deep and well drained. It formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The slopes are medium or long in length. The average annual precipitation is about 22 inches. Mean annual air temperature is about 41 degrees F, and the frost-free period is about 75 days.

In a typical profile, the surface layer is dark reddish brown cobbly loam about 14 inches thick. The subsoil is dark reddish brown or dark red cobbly sandy clay loam about 14 inches thick. It overlies sandstone bedrock at a depth of 28 inches. The depth to bedrock ranges from 24 to 39 inches. This soil is slightly acid. Rock fragment content is about 25 percent in the surface layer, 40 percent in the upper part of the subsoil, and 60 percent in the lower part of the subsoil.

Permeability is moderate above the bedrock. Effective rooting depth is 24 to 39 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

The Rock outcrop is intermingled throughout the complex. It consists of bare exposures of sandstone and quartzite conglomerate on very steep mountainsides and canyon walls. It is more than 90 percent barren, but may support sparse amounts of bluebunch wheatgrass, muttongrass, curlleaf mountainmahogany, or Douglas-fir in pockets and cracks.

This complex is used for range, water supply, and wildlife habitat.

Potential vegetation on the Hoskin soil is bluebunch wheatgrass, Idaho fescue, prairie junegrass, oniongrass, antelope bitterbrush, big sagebrush and some arrowleaf balsamroot, mountain snowberry, and birchleaf mountainmahogany. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants decrease and others increase. Proper grazing is an important management practice in helping to maintain adequate plant cover and the desired composition. Brush management is practical in areas of excessive shrubs and a reasonable understory of desirable grasses and forbs.

This complex has potential for supporting plants that provide food and cover for mule deer, primarily during winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail rabbit, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Inaccessibility, intermingled Rock outcrop, steep slopes, high content of rock fragments, and moderate depth to bedrock are features that limit the potential of this complex for urban and recreational developments. Problems are likely to develop with septic tank absorption fields because of moderate depth to bedrock and steep slopes.

This complex is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

IbG—Isbell loam, 40 to 60 percent slopes. This Isbell soil is very deep and well drained. It occurs dominantly on south- or west-facing, very steep mountainsides at elevations of 5,600 to 7,550 feet. The slopes are medium and long in length. This soil formed in materials weathered from sandstone and shale. The average annual precipitation is about 22 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Hades loam, 40 to 60 percent slopes, Kilfoil loam, 25 to 40 percent slopes and 40 to 60 percent slopes, and Rock outcrop.

In a typical profile, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is very dark grayish brown or dark grayish brown clay loam about 17 inches thick. The substratum is olive brown or olive silty clay in the upper part and loam in the lower part to a depth of 60 inches or more. This soil is neutral in the surface layer and subsoil and slightly or moderately calcareous and strongly alkaline in the substratum. Rock fragment content is about 15 percent in the surface layer and subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and obtaining the desired composition. Brush management is practical in areas with excessive shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is advisable if the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitat for beaver.

The very steep slopes and relative inaccessibility of this soil are features that limit its use for urban and recreational development. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken when disturbing this soil on steep slopes because of the susceptibility to hillside slippage. Septic tank absorption fields will develop problems in some areas of moderately slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil loss to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

IgD—Isbell loam, gravelly substratum, 6 to 15 percent slopes. This Isbell soil is very deep and well drained. It occurs on alluvial fans and stream terraces in mountain valley bottoms at elevations of 5,400 to 6,000 feet. This soil formed in materials weathered from sandstone, quartzite, and some shale. The slopes are medium or long in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Moweba gravelly loam, 6 to 15 percent slopes, Hades loam, 6 to 15 percent slopes, Henefer loam, 6 to 15 percent slopes, and Cumulic Haploborolls, wet.

In a typical profile, the surface layer is very dark brown or very dark grayish brown loam about 17 inches thick. The subsoil is dark yellowish brown or dark brown clay loam about 33 inches thick. The substratum is brown very cobbly loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 25 percent in the lower part of the subsoil and about 70 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the composition of potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs with a reasonable understory of desirable grasses and forbs. Range seeding is advisable if the plant composition shows severe deterioration. Species suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. A successful seeding depends on seedbed preparation, depth of seeding, and time of seeding. State experiment station recommendations should be followed.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential or urban and recreational developments. Septic tank absorption field problems will develop in some areas because of moderately slow permeability in the subsoil. Filter fields placed in the very cobbly loam substratum are a pollution hazard.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining their water supply potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

KaB—Kahler gravelly loam, 3 to 6 percent slopes. This Kahler soil is very deep and well drained. It occurs dominantly on north-facing, long, sloping alluvial fans at elevations of 5,100 to 5,400 feet. This soil formed in alluvium weathered from argillite, schist, and phyllite. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Kahler gravelly loam, 6 to 10 percent slopes, Brownlee loam, 0 to 3 percent slopes, Brownlee loam, 3 to 6 percent slopes, and Lamondi stony loam, 3 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown or very dark grayish brown gravelly loam about 28 inches thick. The subsoil is dark yellowish brown gravelly loam or gravelly sandy loam about 28 inches thick. The upper part of the subsoil is mixed with the surface layer. The substratum is dark yellowish brown gravelly sandy loam to a depth of 73 inches or more. This soil is slightly acid. Rock fragment content is about 30 percent in the surface layer and subsoil and 40 percent in the substratum.

Permeability is moderate. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Principal crops grown are alfalfa and small grains.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture, and 2 to 3 years of small grain. Fall plowing, crop residue use, weed control, and minimum tillage help reduce erosion and maintain good tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer, and legumes respond well to phosphate fertilizer. Fertilizer applications should be in agreement with crop needs, soil tests, and recommendation of the State experiment station. Border, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally determined by the crop. Sprinkler irrigation is well suited to most crops. Border and corrugation methods are well suited to alfalfa, small grains, and pasture. Regardless of the irrigation method used, water should be applied carefully to avoid soil erosion on the steeper slopes. Irrigation application should be adjusted to the available water capacity and intake rate of the soil and the water requirements of the crop grown to avoid overirrigation and leaching of soil nutrients. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that will provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, porcupine, and coyote. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd corners improve the wildlife habitat. Food should be close to cover that will protect the birds from predators and inclement weather.

This soil is well suited to and is being used for homesites and other urban developments, and has good potential for these uses. Where cesspools are used for waste disposal, contamination of the ground water supply is a hazard. Climatically adapted grasses, shrubs, and trees for beautification grow well on this soil.

Recreational use of this soil is mainly snowmobiling. Capability unit IIe-3, irrigated.

KaC—Kahler gravelly loam, 6 to 10 percent slopes. This Kahler soil is very deep and well drained. It occurs dominantly on north- and east-facing, strongly sloping alluvial fans at elevations of 5,100 to 5,550 feet. The slopes are medium or long in length. This soil formed in alluvium from argillite, phyllite, and schist. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Kahler gravelly loam, 3 to 6 percent slopes, Lamondi stony loam, 3 to 15 percent slopes, Trojan loam, warm, 0 to 3 percent slopes, and Brownlee loam, 0 to 3 percent slopes.

In a typical profile, the surface layer is very dark brown gravelly loam or loam about 35 inches thick. The subsoil is brown very gravelly loam about 18 inches thick. The substratum is silt loam to a depth of 63 inches or more. This soil is slightly acid. Rock fragment content is about 20 percent in the surface layer, 55 percent in the subsoil, and 10 percent in the substratum.

Permeability is moderate. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for irrigated and nonirrigated crops.

Principal crops grown under irrigation are small grains and alfalfa. A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture and 2 or 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage help reduce erosion and maintain tilth and water intake rate. Applications of commercial fertilizers are usually needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Fertilizer applications should be in agreement with the crop needs, soil tests, and latest State experiment station recommendations. Border, corrugation, and sprinkler irrigation methods are suitable for this soil. Sprinkler irrigation is considered the most efficient and desirable system for this soil. It is well suited to most crops and allows a controlled application of water to reduce the hazard of erosion and runoff. Irrigation applications should be adjusted to crop needs and available water capacity and intake rate of the soil to avoid overirrigation and leaching of soil nutrients. Where corrugation or border methods are used, irrigation water should be applied across the slope or on the contour to minimize soil losses. Drop structures, pipe, or ditch lining should be in-

stalled in irrigation ditches to facilitate the control of water and to prevent excessive ditch erosion.

When this soil is used for nonirrigated crops, mostly small grain is grown in a continuous cropping system. This soil is well suited to winter wheat and produces higher yields of this crop than it does of spring wheat varieties. Some nonirrigated crops are Ladak alfalfa and pubescent and intermediate wheatgrass for hay or pasture. These crops help control erosion and improve tilth. Fertilizer should be applied to meet plant needs and should be adjusted to soil tests and State experiment station recommendations. Soil erosion can be reduced if fall grain is seeded early and stuble mulch tillage is used. Terraces, diversions, and grassed waterways should be installed where needed. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope to slow the rate of runoff and to help reduce erosion during periods of rapid snowmelt.

This soil has potential for supporting plants that will provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye can be planted along fence rows, ditchbanks, and in odd corners to help improve wildlife habitat.

Some of this soil is being used for homesites and other urban developments. It is well suited for these developments. Where cesspools are used for waste disposal, contamination of the ground water supply is a hazard.

Climatically adapted grasses, shrubs, and trees used for beautification grow well on this soil.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit IIIe-3, irrigated, and IIIe-M, nonirrigated.

KfF—Kilfoil loam, 25 to 40 percent slopes. This Kilfoil soil is moderately deep and well drained. It occurs on convex south-facing mountainsides at elevations of 6,500 to 7,700 feet. Slopes are short or medium in length. This soil formed in materials weathered mostly from sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Isbell loam, 40 to 60 percent slopes, Kilfoil loam, 40 to 60 percent slopes, Hades loam, 40 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark grayish brown loam about 3 inches thick. The subsoil is olive brown, or pale olive loam or silty clay loam about 16 inches thick. The substratum is olive gray silty clay loam in the upper part and light olive brown very cobbly loam in the lower part. Weathered sandstone is at a depth of 37 inches. The depth to bedrock ranges from 24 to 38 inches. This soil is moderately to strongly calcareous and is moderately alkaline. Rock fragment content is about 10 percent in the surface layer, subsoil, and substratum and about 50 percent immediately above the bedrock.

Permeability is moderate. Effective rooting depth is 24 to 38 inches. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, longtongue muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs and a reasonable understory of desirable grasses and forbs. Range seeding is needed where the range vegetation has seriously deteriorated. Species suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Inaccessibility and depth to bedrock are features that limit the potential of this soil for urban development. Septic tank absorption field problems will develop in some areas because of lateral movement of effluent over the bedrock. This effluent movement is a possible pollution hazard to water supplies.

This soil is important for water supply but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIe-M, nonirrigated.

KrG—Kilfoil-Rock outcrop complex, 40 to 60 percent slopes. This complex of Kilfoil soil and Rock outcrop occurs on very steep south-, west- and east-facing mountainsides and canyon walls at elevations of 5,500 to 7,300 feet (fig. 7). The Kilfoil loam, 40 to 60 percent slopes makes up about 65 percent of the complex and the Rock outcrop about 20 percent. The Rock outcrop occurs on ridges and is interspersed throughout the complex as ledges and outcroppings of bare bedrock.

Included in this complex in mapping are small areas of Isbell loam, 40 to 60 percent slopes, Kilfoil loam, 25 to 40 percent slopes, and Hades loam, 40 to 60 percent slopes.

This Kilfoil soil is moderately deep and well drained. It formed in materials weathered from sandstone and shale. The average annual precipitation is about 20 inches, mean annual air temperature is about 41 degrees F, and frost-free season is about 75 days. The slopes are short or medium in length.

In a typical profile, the surface layer is dark brown loam about 3 inches thick. The subsoil is dark brown clay

loam about 18 inches thick. The substratum is yellowish brown gravelly loam about 9 inches thick. Weathered fractured sandstone is at a depth of 30 inches. The depth to the bedrock ranges from 24 to 38 inches. The surface layer is slightly calcareous and mildly alkaline. The subsoil and substratum are moderately calcareous and moderately or strongly alkaline. Rock fragment content is about 15 percent in the surface layer and subsoil and about 35 percent in the substratum.

Permeability is moderate. Effective rooting depth is 24 to 38 inches. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

The Rock outcrop is interspersed throughout the complex as bare sandstone on very steep slopes and canyon walls. It is mostly barren but has a sparse amount of bluebunch wheatgrass, mountain brome, and oakbrush.

The rock outcrop has esthetic value and is used with the Kilfoil soil for wildlife habitat.

This complex is used for range, water supply, and wildlife habitat.

Potential vegetation on the Kilfoil soil is dominantly birchleaf mountainmahogany, bluebunch wheatgrass, Nevada bluegrass, muttongrass, longtongue muttongrass, and some mountain brome, big sagebrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Brush management is practical in areas with excessive shrubs, provided a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable where the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This complex has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, ruffed grouse, blue grouse, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitat for beaver.

This complex is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum.

Inaccessibility, rock outcroppings, very steep slopes, and moderate depth to bedrock are features that limit the potential of this soil for urban development. Septic tank absorption field problems will develop in places because of lateral movement of septic tank effluent over the bedrock. This effluent movement is a pollution hazard to water supplies.

Recreational use of this complex is mainly hunting. Capability unit VIIe-M, nonirrigated.

LaD—Lamondi stony loam, 3 to 15 percent slopes. This Lamondi soil is very deep and well drained. It occurs on alluvial fans on mountain foot slopes at elevations of 5,100 to 5,800 feet. The slopes are medium or long in length. This soil formed in alluvium weathered from argillite, phyllite, schist, and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 85 days.

Included with this soil in mapping are small areas of Kahler gravelly loam, 3 to 6 percent slopes, Kahler gravelly loam, 6 to 10 percent slopes, Yeates Hollow very stony loam, 10 to 30 percent slopes, Trojan loam, warm, 8 to 15 percent slopes, and Fluvaquentic Haploborolls-Fluventic Haploxerolls complex, 1 to 6 percent slopes.

In a typical profile, the surface layer is very dark brown or very dark grayish brown stony loam or cobbly loam about 21 inches thick. The subsoil is dark yellowish brown or yellowish brown very cobbly loam about 31 inches thick. The substratum is dark yellowish brown very gravelly loam to a depth of 61 inches or more. The surface layer is slightly acid and the subsoil and substratum are medium acid. Rock fragment content is about 25 percent in the surface layer and 70 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is Gambel oak, bearded wheatgrass, bluebunch wheatgrass, mountain brome, Nevada bluegrass, slender wheatgrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, horsemint, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas with excess shrubs if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable where the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments. Some areas are presently being used for golf courses, cabin sites, home sites, and ski lodges. The scattered stones on the soil surface and the content of rock fragments in the soil are features that limit the use of this soil for urban and recreational developments.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting, snowmobiling, golfing, and summer homes. Capability unit VIe-M, nonirrigated.

LaE—Lamondi stony loam, 15 to 30 percent slopes. This Lamondi soil is very deep and well drained. It occurs on alluvial fans at elevations of 5,600 to 7,000 feet. The slopes are medium or long in length. This soil formed in alluvium from weathered quartzite, argillite, phyllite, and schist. The average annual precipitation is about 22 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 80 days.

Included with this soil in mapping are small areas of Ostler loam, 20 to 50 percent slopes, Poleline stony loam, 40 to 70 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, and St. Marys very stony loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown stony loam about 21 inches thick. The subsoil is brown very gravelly loam, gravelly loam, or very cobbly loam to a depth of 60 inches or more. The surface layer is slightly acid and the subsoil is medium acid. Rock fragment content is about 25 percent in the surface layer and about 50 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is Gambel oak, bearded wheatgrass, bluebunch wheatgrass, mountain brome, Nevada bluegrass, slender wheatgrass, birchleaf mountain-mahogany, and some arrowleaf balsamroot, horsemint, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical on areas with excess shrubs if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil has potential for urban and recreational developments. The scattered stones over the soil surface and the high content of rock fragment in the soil are features that limit this soil for urban and recreational developments.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

LHG—Lithic Haploxerolls-Rock outcrop complex, 40 to 80 percent slopes. This complex of Lithic Haploxerolls and Rock outcrop, 40 to 80 percent slopes occurs on very steep convex mountain slopes, canyon walls, and ridges at elevations of 5,200 to 8,000 feet. The Lithic Haploxerolls, 40 to 80 percent slopes, make up about 50 percent of the complex. The Rock outcrop occurs on the ridges and throughout the map unit as ledges and outcroppings of bare bedrock. It makes up about 25 percent of the complex.

Included with this complex in mapping are small areas of rubble land, Agassiz stony silt loam, 40 to 70 percent slopes, Foxol very cobbly loam, 40 to 70 percent slopes, Hoskin cobbly loam, 50 to 70 percent slopes, Horrocks gravelly loam, 40 to 70 percent slopes, Kilfoil loam, 40 to 60 percent slopes, and Wallsburg gravelly loam, 40 to 60 percent slopes.

Lithic Haploxerolls are shallow and well drained. They formed in materials weathered from sandstone, quartzite, limestone conglomerate, and shale. The slopes are short or medium in length. The average annual precipitation is about 20 inches, mean annual air temperature is about 42 degrees F, and the average frost-free season is about 90 days.

No one profile is typical of Lithic Haploxerolls, but in one of the more common ones the surface layer is very dark grayish brown stony loam about 6 inches thick. The underlying layer is yellowish brown stony clay loam. At a depth of 20 inches is weathered sandstone and shale. Depth to bedrock ranges from 10 to 20 inches. These soils are strongly calcareous and moderately alkaline. Rock fragment content is about 30 percent in the surface layer and 40 percent in the underlying layer. The soils generally are loam, clay loam, or sandy loam with 35 to 80 percent rock fragments.

Permeability is generally moderate or moderately slow. Effective rooting depth is generally less than 20 inches but may be concentrated in cracks and fractures in the bedrock. The available water capacity is low or very low. Surface runoff is rapid. Erosion hazard is high.

Lithic Haplxerolls are used for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, muttongrass, basin wildrye, Nevada bluegrass, big sagebrush, and some arrowleaf balsamroot, antelope bitterbrush, Gambel oak, mountain snowberry and birchleaf mountain-mahogany. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. They also are potential habitat for chukar, sharp-tailed grouse, coyote, bobcat, and porcupine.

The Rock outcrop is interspersed throughout the complex as bare sandstone, quartzite, and conglomerates of sandstone, quartzite, and limestone. It is mostly barren

but may have a sparse amount of bluebunch wheatgrass, Gambel oak, birchleaf mountainmahogany, and some Douglas-fir and Utah juniper growing in pockets, fractures, and cracks in the bedrock.

The Rock outcrop has esthetic value and is used with the Lithic Haploxerolls for wildlife habitat.

This complex is important for water supply and adequate plant cover should be maintained to keep soil losses to a minimum.

The soils in this complex have low potential for urban or recreational developments because of very steep slopes, shallow depth to bedrock, and exposures of bedrock. Septic tank absorption field and water supply pollution problems will develop in areas because of lateral movement of septic tank effluent over the bedrock.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

LkD—Lucky Star silt loam, 15 to 30 percent slopes. This Lucky Star soil is very deep and well drained. It occurs dominantly on north- and east-facing, moderately steep and steep high mountainsides and associated alluvial fans. Elevation ranges from 6,000 to 8,000 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Charcol gravelly fine sandy loam, 30 to 50 percent slopes, Herd cobbly clay loam, 3 to 15 percent slopes, Ercan loam, 3 to 15 percent slopes, and Yeljack loam, 6 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown silt loam in the upper part and gravelly loam in the lower part and is about 20 inches thick. The subsurface layer is dark brown cobbly sandy loam about 20 inches thick. The upper part of the subsoil is reddish brown cobbly clay loam about 7 inches thick. The lower part of the subsoil and substratum are mixed. This layer is cobbly loamy sand and cobbly sandy clay loam to a depth of 60 inches or more. The surface layer is neutral or slightly acid and the subsurface layer, subsoil, and substratum are slightly acid.

Rock fragment content is about 15 percent in the upper part of the surface layer and 25 percent in the lower part. It is about 50 percent in the subsurface layer, subsoil, and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for woodland, grazing, water supply, and wildlife habitat.

Potential vegetation is dominantly quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding bromegrass, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an essential management practice for helping to maintain adequate plant cover and the desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition delays natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitat for beaver.

Because of moderately rapid permeability of this soil, seepage from septic tank drainage fields or cesspools is a pollution hazard to water supplies. With the proper planning, this soil has potential for cabin sites and recreational developments.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil loss to a minimum, thus maintaining its watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-H, nonirrigated.

LkG—Lucky Star silt loam, 30 to 60 percent slopes. This Lucky Star soil is very deep and well drained. It occurs on very steep, dominantly north- and east-facing, concave high mountainsides. The slopes are medium and long in length. Elevation ranges from 6,000 to 8,500 feet. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Charcol gravelly fine sandy loam, 30 to 50 percent slopes, Ercan loam, 15 to 30 percent slopes, Ercan loam, 30 to 60 percent slopes, and Moweba gravelly loam, 30 to 50 percent slopes.

In a typical profile, the surface layer is very dark brown silt loam in the upper part and gravelly silt loam in the lower part and is about 19 inches thick. The subsurface layer is brown gravelly loam or very gravelly sandy loam about 28 inches thick. The subsoil is mixed with the subsurface layer. It is brown or reddish brown very gravelly clay loam to a depth of 74 inches or more. This soil is neutral in the surface layer and slightly acid in the subsurface layer and subsoil. Rock fragment content is about 10 percent in the upper part of the surface layer and 25 percent in the lower part. Between a depth of 19 to 57 inches, rock fragment content is about 50 percent, and it is about 70 percent below a depth of 57 inches.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for woodland, grazing, water supply, and wildlife habitat.

Potential vegetation is dominantly quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding brome, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an essential management practice for helping to maintain adequate plant cover and the desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet of 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition will delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods used in tree harvest are difficult because of the very steep slopes. High lead logging method is more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitat for beaver.

Because of very steep slopes and inaccessibility, this soil is not presently used for urban or recreational developments.

This soil is important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

LmG—Lucky Star-Charcol complex, 30 to 60 percent slopes. This complex of Lucky Star and Charcol soils occurs on very steep, high mountainsides at elevations of 7,000 to 8,200 feet. The Lucky Star silt loam, 30 to 60 percent slopes occurs dominantly on the north- and east-facing concave side slopes under a cover of quaking aspen. The Charcol gravelly fine sandy loam, 30 to 50 percent slopes, occurs on east-, south-, and west-facing convex side slopes under a cover of grasses, forbs, and shrubs. Each of these soils make up about 40 percent of the complex.

Included with these soils in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, Condie gravelly loam, 30 to 60 percent slopes, Moweba gravelly loam, 30 to 50 percent slopes, Hoskin cobbly loam, 30 to 50 percent slopes, and Herd cobbly clay loam, 3 to 15 percent slopes.

The Lucky Star soil is very deep and well drained. It formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 30 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is very dark brown silt loam in the upper part and gravelly silt loam in the lower part and is about 19 inches thick. The subsurface layer is brown gravelly loam or very gravelly sandy loam about 28 inches thick. The subsoil is mixed with the subsurface layer. It is brown or reddish brown very gravelly clay loam to a depth of 74 inches or more. This soil is neutral in the surface layer and slightly acid in the subsurface layer and subsoil. Rock fragment content is about 10 percent in the upper part of the surface layer and 25 percent in the lower part. Between depths of 19 to 57 inches the rock fragment content is about 50 percent. It is about 70 percent below a depth of 57 inches.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for woodland, grazing, water supply, and wildlife habitat.

Potential vegetation is dominantly quaking aspen with understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding brome, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an essential management practice for helping to maintain adequate plant cover and the desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition will delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods used in tree harvest are difficult because of the very steep slopes. High lead logging method is more efficient and less damaging to the soil surface.

The Charcol soil is very deep and well drained. It formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 30 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is very dark brown or dark reddish brown gravelly fine sandy loam about 27 inches thick. The subsurface layer is yellowish red gravelly fine sandy loam about 13 inches thick. The subsoil is dark red or red gravelly sandy clay loam, or gravelly fine sandy loam about 18 inches thick. The substratum is red clay loam to a depth of 72 inches or more. This soil is slightly acid. Rock fragment content is about 20 percent in the surface layer, 50 percent in the subsurface layer, and 35 percent in the subsoil. The substratum lacks rock fragments.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This complex is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly slender wheatgrass, Gambel oak, basin wildrye, mountain brome, and some aspen peavine and butterweed. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and the desired composition. Range seeding is advisable if the vegetation has seriously deteriorated. Because of the very steep slopes, broadcast and aerial methods of seeding are practical. Grasses suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, Garrison meadow foxtail, and orchardgrass.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during summer and fall. They are also potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams that run through the area are potential habitat for beaver.

Because of steep slopes and inaccessibility, these soils are not presently planned for homesites or recreational developments. Pollution of water supplies from effluent is a hazard where these soils are used for septic tank filter fields because of their moderately rapidly permeable substratum.

These soils are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Capability unit VIIe-H, nonirrigated.

LNG—Lucky Star-Ercan association, very steep. This association of Lucky Star and Ercan soils occurs on strongly sloping to very steep, high mountainsides and high mountaintops at elevations of 6,700 to 9,100 feet. Lucky Star silt loam, 15 to 30 percent slopes, and Lucky Star silt loam 30 to 60 percent slopes, make up about 50 percent of the association. Ercan loam, 3 to 15 percent slopes, and Ercan loam, 15 to 30 percent slopes, make up about 30 percent of the association. The slopes are medium or long in length. The average annual precipitation for the soils in this association is about 35 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 50 days.

Included with this association in mapping are small areas of Charcol gravelly fine sandy loam, 30 to 50 percent slopes, Yeljack loam, 6 to 15 percent slopes, Yeljack loam, 15 to 30 percent slopes, and Hoskin cobbly loam, 30 to 50 percent slopes.

The Lucky Star soils are very deep and well drained. They formed in materials weathered from a conglomerate of quartzite and sandstone.

In a typical profile, the surface layer is very dark brown silt loam in the upper part and gravelly silt loam in the lower part and is about 19 inches thick. The subsurface layer is brown gravelly loam or very gravelly sandy loam about 28 inches thick. The subsoil is mixed with the subsurface layer. It is brown or reddish brown very gravelly clay loam to a depth of 74 inches or more. These soils are neutral in the surface layer and slightly acid in the subsurface layer and subsoil. Rock fragment content is about 10 percent in the upper part of the surface layer and 25 percent in the lower part. Between a depth of 19 to 57 inches the rock fragment content is about 50 percent. It is about 70 percent below a depth of 57 inches.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

The Ercan soils are deep and well drained. They formed in materials weathered mostly from sandstone.

In a typical profile, the surface layer is dark brown or dark reddish loam about 31 inches thick. The subsurface layer is mixed with the subsoil, and is reddish brown loam about 8 inches thick. The subsoil is red clay loam in the upper part and is about 13 inches thick. The lower part of the subsoil is gravelly clay loam to a depth of 60 inches or more. This soil is slightly acid or neutral. Rock fragment content is about 40 percent in the lower part of the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high. This soil is a major source of sediment pollution in streams, ponds, and reservoirs if it is disturbed and the necessary conservation practices are not applied.

The soils in this association are used mainly for grazing, woodland, water supply, and wildlife habitat.

Potential vegetation on both soils is dominantly quaking aspen with an understory of bearded wheatgrass, blue wildrye, mountain brome, nodding bluegrass, nodding brome, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

These soils are suited for the production of quaking aspen. They are capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition will delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods of tree harvest are suitable in the flatter areas but are difficult to use on the steeper slopes. The high lead logging method is more efficient and less damaging to the soil surface on the steep slopes.

These soils have potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. They also are potential habitat for ruffed grouse, blue grouse, sharp-tailed grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the area are potential habitat for beaver.

The soils in the flatter areas have potential for cabin sites and other recreational developments. The Ercan soils have a moderate ability to support loads which could cause some problems for this use. Septic tank absorption fields will develop problems in some areas because of moderately slow permeability in the Ercan soils. Lucky Star soils have moderately rapid permeability in the substratum, and pollution of water supplies is a hazard when these soils are used for septic tank filter fields.

The soils in this association are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

Recreational uses of these soils are hunting and snowmobiling. Not placed in a capability unit (all in National Forest).

MbA—Manila loam, 0 to 3 percent slopes. This Manila soil is very deep and well drained. It occurs on nearly level and gently rolling high lake terraces at elevations of 4,900 to 5,400 feet. The slopes are short or medium in length. This soil formed in materials weathered mostly from sandstone and quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Manila loam, 3 to 6 percent slopes, Yeates Hollow loam, 2 to 5 percent slopes, Trojan loam, warm, 0 to 3 percent slopes, and Crooked Creek silty clay loam.

In a typical profile, the surface layer is very dark brown loam in the upper part and clay loam in the lower part and is about 17 inches thick. The subsoil is brown, reddish brown or dark brown clay or heavy clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer and subsoil.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. The principal crops grown are alfalfa and small grain.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture and 2 to 3 years of small grain. Fall plowing, crop residue use, weed control, and minimum tillage help reduce soil erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Fertilizer applications should be in agreement with crop needs, soil tests, and State experiment station recommendations. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Border irrigation is suitable for alfalfa, small grains, and pasture. Land leveling is necessary on some areas to facilitate and obtain an even distribution of irrigation water under border, furrow, or corrugation methods. Irrigation intervals should be adjusted to crop needs and available water capacity of the soil. Irrigation streams should not cause soil movement in furrows, corrugations, or borders. Length of runs should be adjusted to the water intake rate of soils so that water reaches the end of field without overirrigating the upper part. These practices will help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that will provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve wildlife habitat on this soil. Food should be close to cover that protects the birds from predators and inclement weather.

Some areas of this soil are used for homesites and other urban developments. The limited ability to support a load is a soil feature that limits these soils for urban or recreational developments. Dwellings and roads can be designed to offset this soil limitation. Septic tank absorption fields will develop problems in some areas because of slow permeability.

Recreational use of this soil is mainly snowmobiling. Capability unit IIc-3, irrigated.

MbB—Manila loam, 3 to 6 percent slopes. This Manila soil is very deep and well drained. It occurs dominantly on south- and west-facing, sloping high lake terraces at elevations of 5,000 to 5,150 feet. The slopes are short or medium in length. This soil formed mostly in materials weathered from sandstone and quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Manila loam, 0 to 3 percent slopes, Manila loam, 6 to 10 percent slopes, and Yeates Hollow cobbly loam, 6 to 10 percent slopes.

In a typical profile, the surface layer is very dark grayish brown loam in the upper part and clay loam in the lower part and is about 13 inches thick. The subsoil is dark brown, reddish brown, or brown silty clay or heavy clay loam about 34 inches thick. The substratum is strong brown fine sandy loam to a depth of 60 inches or more. This soil is slightly acid.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated and nonirrigated crops. The principal crops grown are alfalfa and small grain.

A suitable crop rotation under irrigation is 6 to 8 years of alfalfa or improved pasture and 2 to 3 years of small grain. Fall plowing, crop residue use, weed control, and minimum tillage are recommended practices to help reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Fertilizer applications should be in agreement with the crop needs, soil tests, and State experiment station recommendations. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The irrigation method used is generally governed by the crop grown. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Borders are well adapted to alfalfa, small grains, and pasture. Regardless of the irrigation method used, water should be applied carefully and adjusted to the available water capacity and water intake rate of the soil and the water needs of the crop to avoid overirrigation and leaching of plant nutrients. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

When this soil is used for nonirrigated crops, mostly fall grain is grown in a continuous cropping system. This soil is well suited to winter wheat and produces higher yields of this crop than it does of spring wheat varieties. Some areas are planted to pubescent or intermediate wheatgrass and Ladak alfalfa for hay or pasture. These plantings help to reduce erosion and improve tilth. Fertilizer should be applied to meet plant needs for maximum forage production. Soil erosion can be reduced if fall grain is seeded early and stubble mulch tillage is used. Terraces, diversions, and grassed waterways should be installed if needed. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope. These practices tend to slow down the rate of runoff and reduce erosion during periods of rapid snowmelt.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve wildlife habitat. Food should be close to cover that will protect the birds from predators and inclement weather.

Some of this soil is used for homesites and urban developments. The limited ability to support a load is a feature that limits use for urban or recreational developments. Dwellings and roads properly designed offsets this soil feature. Septic tank absorption fields will develop problems in some areas because of slow permeability of the Manila soils.

Recreational use of this soil is mainly snowmobiling. Capability units IIIe-3, irrigated, and IIIe-M, nonirrigated.

MbC—Manila loam, 6 to 10 percent slopes. This Manila soil is very deep and well drained. It occurs dominantly on strongly sloping high lake terraces and mountain foot slopes at elevations of 5,000 to 6,500 feet. The slopes are short, medium, or long in length. This soil formed in materials weathered from sandstone and quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Manila loam, 3 to 6 percent slopes, Manila loam, 10 to 25 percent slopes, Ant Flat loam, 6 to 15 percent slopes, and Yeates Hollow cobbly loam, 6 to 10 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and clay loam in the lower part and is about 17 inches thick. The subsoil is brown, reddish brown, or dark brown clay or heavy clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer and subsoil.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for irrigated and nonirrigated crops. The principal crops grown under irrigation are alfalfa and small grains.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture, and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage help reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Fertilizer applications should be in agreement with crop needs, soil tests, and State experiment station recommendations. Border, corrugation, and sprinkler irrigation methods are suitable for the soil. Sprinkler irrigation is efficient and a desirable system for this soil. It is adapted to most crops and controlled application of water is needed to reduce soil erosion and surface runoff. Irrigation water applications should be adjusted to available water capacity and intake rate and needs of the crop to avoid overirrigation and leaching of plant nutrients. If corrugation or border methods are used, irrigation water should be applied across the slope or on the contour to minimize soil losses. Drop structures, pipes, or ditch lining should be installed in irrigation ditches to facilitate the control of water and to prevent excessive ditch erosion.

When the soil is used for nonirrigated crops, mostly small grain is grown in a continuous cropping system. This soil is well suited to winter wheat and produces higher yields of this crop than of spring wheat varieties. Some areas are planted to Ladak alfalfa and pubescent and intermediate wheatgrass for hay or pasture. Fertilizer should be applied to meet plant needs for maximum crop production. Soil erosion can be reduced if fall grain

is seeded early and stubble mulch tillage is used. Terraces, diversions, and grassed waterways should be installed where needed. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope. These practices tend to slow the rate of runoff and reduce erosion during periods of rapid snowmelt.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the habitat for wildlife. Food should be close to cover that will protect the birds from predators and inclement weather.

Some areas of this soil are used for homesites and other urban developments. The limited ability to support a load is a soil feature that limits use for urban or recreational developments. Proper design of dwellings and roads offsets this soil feature. Septic tank absorption fields develop problems in some areas because of the slow permeability of the Manila soils.

Recreational use of this soil is mainly snowmobiling. An area adjacent to East Canyon Reservoir is used for picnicking, camping, and to facilitate water skiing, boating, swimming, and fishing in the reservoir waters. Capability units IIIe-3, irrigated, and IIIe-M, nonirrigated.

MbD—Manila loam, 10 to 25 percent slopes. This Manila soil is very deep and well drained. It occurs on moderately steep high lake terraces and mountain foot slopes at elevations of 5,000 to 6,200 feet. The slopes are short, medium, or long in length. This soil formed in materials weathered mostly from sandstone and quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Manila loam, 6 to 10 percent slopes, Manila loam, 25 to 40 percent slopes, Yeates Hollow cobbly loam, 6 to 10 percent slopes, Yeates Hollow very stony loam, 10 to 30 percent slopes, and Ant Flat loam, 6 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 6 inches thick. The subsoil is very dark brown, dark brown, reddish brown, or brown heavy clay loam or clay to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 5 percent in the lower part of the subsoil.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for nonirrigated crops, range, water supply, and wildlife habitat. Some small areas are used for irrigated crops. The principal crops grown are alfalfa and small grains.

A suitable crop rotation is 6 to 8 years of alfalfa or improved pasture and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are recommeded practices that help reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizer are commonly needed in addition to manure and plant residues. Generally, all crops respond readily to nitrogen fertilizer, and legumes respond readily to phosphate fertilizers. Fertilizer applications should be made in agreement with the crop needs, soil tests, and State experiment station recommendations. Sprinkler application of irrigation water is practical for this soil. This system allows for controlled applications of irrigation water to avoid erosion and surface runoff. Applications of irrigation water should be adjusted to the available water capacity, water intake rate, and crop needs to avoid overirrigating and leaching of plant nutrients.

When the soil is used for nonirrigated crops, mostly small grains are grown in a continuous cropping system. This soil is suited to winter wheat, and higher yields are produced of this crop than of spring wheat varieties. Some areas are planted to Ladak alfalfa and pubescent and intermediate wheatgrass for hay or pasture. Fertilizer should be applied to meet plant needs for maximum crop production. Erosion can be reduced if fall grain is seeded early and if stubble-mulch tillage is used. Terraces, diversions, and grassed waterways should be installed where needed. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be on the contour or across the slope. These practices tend to slow down the rate of runoff and reduce erosion during periods of rapid snowmelt.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Successful range seedings depend on seedbed preparation, depth of seeding, and time of seeding.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, coyote, weasel, and badger.

The limited ability to support a load and the high shrink-swell potential are soil features that limit the use of this soil for urban or recreational developments. Dwellings and roads can be designed to offset these soil

features. Care should be taken in disturbing this soil on the steeper slopes because of susceptibility to hillside slippage. Septic tank absorption fields develop problems in some areas because of slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Small areas adjacent to Pineview Reservoir and East Canyon Reservoir are used for picnicking and camping and to facilitate water skiing, swimming, and boating on the reservoir. Capability units IVe-3, irrigated, and IVe-M, nonirrigated.

MbE—Manila loam, 25 to 40 percent slopes. This Manila soil is very deep and well drained. It occurs on steep and very steep mountainsides at elevations of 5,200 to 6,500 feet. The slopes are short or medium in length. This soil formed in materials weathered mostly from sandstone and quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 85 days.

Included with this soil in mapping are small areas of Manila loam, 10 to 25 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, Yeates Hollow very stony loam, 10 to 30 percent slopes, Ant Flat loam, 6 to 15 percent slopes, and Henefer loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and clay loam in the lower part and is about 17 inches thick. The subsoil is brown, reddish brown, or dark brown clay or heavy clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer and subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas with excessive shrubs if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, coyote, weasel, and badger.

The limited ability to support a load and the high shrink-swell potential are the soil features that limit the use of this soil for urban or recreational developments. Dwellings and roads can be designed to offset these soil features. Care should be taken in disturbing this soil on the steeper slopes because of susceptibility to hillside slippage. Septic tank absorption fields develop problems in some areas because of slow permeability.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Small areas adjacent to the Pineview Reservoir and East Canyon Reservoir are used to facilitate fishing, water skiing, swimming, and boating on the reservoir. Capability unit VIe-M, nonirrigated.

McD—Manila-Yeates Hollow complex, 10 to 25 percent slopes. This complex of Manila and Yeates Hollow soils occurs dominantly on west- and south-facing, moderately steep and steep, rolling mountain foot slopes at elevations of 5,660 to 6,800 feet. The Manila loam, 10 to 25 percent slopes, makes up about 50 percent of the complex. It occurs on the concave, medium and long slopes. The Yeates Hollow very stony loam, 10 to 30 percent slopes, makes up about 40 percent of the complex. It occurs on the convex, short and medium slopes on ridges and knolls.

Included with this complex in mapping are small areas of Hawkins silty clay, 6 to 15 percent slopes, and Donner cobbly loam, 10 to 30 percent slopes.

Both the Manila and Yeates Hollow soils formed in materials weathered mostly from sandstone and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 80 days.

The Manila soil is very deep and well drained. In a typical profile, the surface layer is very dark grayish brown loam in the upper part and clay loam in the lower part and is about 11 inches thick. The upper part of the subsoil is dark brown silty clay about 21 inches thick. The lower part of the subsoil is brown clay loam about 18 inches thick. The substratum is brown loam to a depth of 62 inches or more. The surface layer is slightly acid. The upper part of the subsoil is neutral. The lower part of the subsoil and the substratum are slightly calcareous and strongly alkaline or moderately alkaline. Rock fragment content is about 15 percent in the surface layer and subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is high.

The Yeates Hollow soil is deep and well drained. In a typical profile, the surface layer is very dark brown or dark brown very stony loam or cobbly heavy loam about 13 inches thick. The subsoil is brown or yellowish red cobbly or very cobbly clay loam about 29 inches thick. Bedrock is at a depth of 42 inches. The depth to bedrock ranges from 40 to 60 inches or more. This soil is slightly

acid. The soil surface has 10 to 25 percent cover of rock fragments. Rock fragment content is about 35 percent in the surface layer and in the upper part of the subsoil. The lower part of the subsoil is about 75 percent rock fragment.

Permeability is slow. Effective rooting depth is 40 to 60 inches or more. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The Manila and Yeates Hollow soils are used for range, water supply, and wildlife habitat.

Potential vegetation for the Manila soil is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some arrowleaf balsamroot, antelope bitterbrush, big sagebrush, and mountain snowberry. Potential vegetation for the Yeates Hollow soil is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some oniongrass, Idaho fescue, prairie junegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and other plants decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical on areas with excessive shrubs, provided a reasonable understory of desirable grasses and forbs is present. If the vegetation has seriously deteriorated, range seeding is advisable on the Manila soil. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail. Successful seeding depends on seedbed preparation, depth of seeding, and time of seeding.

These soils have potential for supporting plants that provide food and cover for mule deer during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams in the area are potential habitat for beaver.

These soils have potential for urban or recreational developments. The Manila soil's limited ability to support a load and high shrink-swell potential are soil features that limit use for urban and recreational developments. The high rock fragment content and depth to bedrock are soil features that limit the use of the Yeates Hollow soil for urban and recreational developments. Septic tank absorption field problems will develop in some areas of both these soils because of their slow permeability and steep slopes and because of the depth to bedrock in the Yeates Hollow soils.

Recreational uses of these soils are mainly hunting and snowmobiling. Capability unit VIIs-M, nonirrigated.

McG—Manila-Yeates Hollow complex, 25 to 70 percent slopes. This complex of Manila and Yeates Hollow soils occurs dominantly on south- and west-facing, very steep mountainsides at elevations of 5,650 to 7,000 feet. The Manila loam, 25 to 40 percent slopes, makes up about 50 percent of the complex. It occurs on medium and long concave side slopes. The Yeates Hollow very stony loam, 30 to 70 percent slopes, makes up about 40 percent of the complex. It occurs on convex ridges and knolls. Slopes are short and medium in length.

Included with this complex in mapping are small areas of Yeates Hollow very stony loam, 10 to 30 percent slopes, Manila loam, 10 to 25 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, Donner cobbly loam, 30 to 50 percent slopes, and Durfee stony loam, 30 to 70 percent slopes.

Both the Manila and Yeates Hollow soils formed in materials weathered mostly from sandstone and quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 75 days.

The Manila soil is very deep and well drained. In a typical profile, the surface layer is very dark brown loam in the upper part and clay loam in the lower part and is about 17 inches thick. The subsoil is brown, reddish brown, or dark brown clay or heavy clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer and subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

The Yeates Hollow soil is deep and well drained. In a typical profile, the surface layer is very dark brown or dark brown, very stony loam or cobbly loam about 13 inches thick. The subsoil is brown or yellowish red cobbly or very cobbly clay loam about 29 inches thick. Bedrock is at a depth of 42 inches. The depth to bedrock ranges from 40 to 60 inches or more. This soil is slightly acid. The soil surface has 10 to 25 percent cover of rock fragments. Rock fragment content is about 35 percent in the surface layer and in the upper part of the subsoil and 75 percent in the lower part of the subsoil.

Permeability is slow. Effective rooting depth is 40 to 60 inches or more. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The Manila and Yeates Hollow soils are used for range, water supply, and wildlife habitat.

Potential vegetation for the Manila soil is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some arrowleaf balsamroot, antelope bitterbrush, big sagebrush, and mountain snowberry. Potential vegetation for the Yeates Hollow soil is dominantly bluebunch wheatgrass, muttongrass, birchleaf mountainmahogany, Nevada bluegrass, and some oniongrass, Idaho fescue, prairie junegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a

reasonable understory of desirable grasses and forbs is present.

These soils have potential for supporting plants that provide food and cover for mule deer during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams in the area are potential habitat for beaver.

Because of inaccessibility and very steep slopes, these soils have not been used for urban or recreational developments. The Manila soil's limited ability to support a load and the high shrink-swell potential are soil features that limit use for such developments. Care should be taken when disturbing the Manila soil on steep slopes, because of susceptibility to hillside slippage. The high rock fragment content is a soil feature that limits the use of the Yeates Hollow soil. Septic tank absorption fields on both soils develop problems in places because of slow permeability and steep slopes, and the depth to bedrock in the Yeates Hollow soils.

Recreational use of these soils is mainly hunting. Capability unit VIIs-M, nonirrigated.

MeD—Mondey clay loam, 8 to 15 percent slopes. This Mondey soil is very deep and well drained. It occurs dominantly on north- and east-facing, concave rolling hills and mountain foot slopes at elevations of 5,100 to 5,800 feet. The slopes are short or medium in length. This soil formed in materials weathered from sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Mondey clay loam, 15 to 30 percent slopes, Manila loam, 10 to 25 percent slopes, Manila loam, 6 to 10 percent slopes, and Eastcan variant loam, cool, 6 to 10 percent slopes.

In a typical profile, the surface layer is very dark brown clay loam about 9 inches thick. The subsoil is dark brown or reddish brown clay about 22 inches thick. The substratum is dark brown or brown clay loam or loam to a depth of 60 inches or more. The surface layer and subsoil are slightly acid. The substratum is moderately calcareous or strongly calcareous and neutral. The surface layer has been mixed with the subsoil to a depth of about 31 inches.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for nonirrigated and irrigated crops (fig. 8).

When used for irrigated crops, alfalfa, small grains, and pasture are the principal crops. A suitable crop rotation is 6 to 8 years of alfalfa or pasture and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to reduce erosion and help to maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Fertilizer applications should be in agreement with crop needs, soil tests, and recommendations of the State experiment station. Sprinkler irrigation systems are suitable for this soil. Sprinkler systems provide the control necessary for even distribution and application of irrigation waters to these sloping and moderately steep soils to prevent excess soil erosion and surface runoff. Irrigation applications should be adjusted to the crop needs and the available water capacity to avoid overirrigation and leaching of plant nutrients.

When used for nonirrigated crops this soil is mostly in a continuous cropping system. Soil erosion is a primary problem on the steep slopes, and these areas should be in permanent cover about 75 percent of the time. Ladak alfalfa and intermediate wheatgrass are suitable species for hay and pasture. Winter wheat and barley are the principal small grain crops. Winter wheat produces higher yields than spring wheat varieties. Fertilizer should be applied to meet plant needs for maximum crop production on grasses and small grains. Practices that help to reduce soil erosion include seeding early in the fall, stubble-mulch tillage, construction of terraces, diversions, grassed waterways, and drop structures in some grassed waterways, where needed. All tillage practices should be either on the contour or across the slope. These practices tend to slow the rate of runoff and reduce soil erosion during periods of rapid runoff from snowmelt or high intensity rains.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye can be planted along fence rows and ditchbanks and in odd corners to improve wildlife habitat. Food should be close to cover that will protect the birds from predators and inclement weather.

This soil is not used for homesites or urban developments. The limited ability to support a load is a soil feature that limits its use for urban or recreational developments. Dwellings and roads can be designed to offset this soil feature. Septic tank absorption fields develop problems in some areas because of slow permeability.

Recreational use of this soil is mainly snowmobiling. Capabiity units IIIe-3, irrigated, and IVe-M, nonirrigated.

MeE—Mondey clay loam, 15 to 30 percent slopes. This Mondey soil is very deep and well drained. It occurs on all aspects on moderately steep and steep rolling hills and mountainsides at elevations of 5,100 to 5,800 feet. The slopes are short or medium in length. This soil formed in materials weathered mostly from sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Richville gravelly loam, 30 to 60 percent slopes, Eastcan variant loam, cool, 6 to 10 percent slopes, Manila loam, 10 to 25 percent slopes, and Mondey clay loam, 8 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown clay loam about 9 inches thick. The subsoil is dark brown or reddish brown clay about 22 inches thick. The substratum is dark brown or brown clay loam or loam to a depth of 60 inches or more. The surface layer and subsoil are slightly acid. The substratum is moderately calcareous or strongly calcareous and neutral.

Permeability is slow. Intake rate is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for nonirrigated crops. Some areas are used for range.

The steeper areas should be seeded to permanent cover. Species suitable for seeding include Ladak alfalfa and intermediate wheatgrass. The flatter areas are used for a continuous cropping system, but should be planted to permanent cover 75 percent of the time. The principal crops grown are winter wheat and barley. Fertilizer should be applied to meet plant needs for maximum crop production. Soil erosion is a problem on the steep slopes. Practices such as seeding early in the fall, stubble-mulch tillage, terraces, diversions, grassed waterways, and drop structures installed where they are needed help control soil erosion. All tillage practices should be on the contour or across the slope. These practices help to slow the rate of runoff during periods of rapid snowmelt or high intensity rains.

Potential vegetation is dominantly slender wheatgrass, bluebunch wheatgrass, Idaho fescue, Letterman needlegrass, prairie junegrass, and some basin wildrye, Columbia needlegrass, western wheatgrass, lupine, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas with excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the range vegetation has severely deteriorated. Species suitable for seeding include Ladak alfalfa, smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, intermediate wheatgrass, and Garrison meadow foxtail. Some previously cropped areas are now planted to intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for sharp-tailed grouse, cottontail and jackrabbit, Hungarian partridge, and coyote.

This soil is not used for urban or recreational developments. The steep slopes, high shrink-swell potential, and the limited ability to support a load are soil features that limit development. Roads and dwellings can be designed to offset these limitations. Care should be taken when disturbing this soil on steep slopes because it is susceptible to hillside slippage. Septic tank absorption fields will develop problems in some places because of slow permeability and steep slopes.

Recreational uses of this soil are mainly hunting, snowmobiling, and snow tubing. Capability unit VIe-M, nonirrigated.

MoG—Morgala loam, 30 to 60 percent slopes. This Morgala soil is very deep and well drained. It occurs on smooth to convex very steep mountainsides at elevations of 5,500 to 7,000 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from sandstone. The average annual precipitation is about 22 inches. Mean annual air temperature is about 45 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of Norcan loam, 30 to 60 percent slopes, Toncana loam, 40 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark reddish brown loam about 4 inches thick. The upper part of the subsoil is dark reddish brown or dark red silty clay loam about 35 inches thick. The lower part of the subsoil is dark red gravelly silty clay loam to a depth of 60 inches or more. This soil is neutral in the surface layer and the upper part of the subsoil and is moderately calcareous or strongly calcareous and moderately alkaline in the lower part of the subsoil. Rock fragment content is about 15 percent in the upper part of the subsoil and about 25 percent in the lower part.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. The erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is Gambel oak, bluebunch wheatgrass, bearded wheatgrass, mountain snowberry, Utah snowberry, serviceberry, bigtooth maple, and some slender wheatgrass, western goldenrod, and big sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, provided a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable where the range vegetation has seriously deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for

sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

Because of very steep slopes and relative inaccessibility this soil has not been used for urban or recreational developments. Septic tank absorption field problems develop in some areas because of slow permeability and steep slopes.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

MrG—Morgala-Rock outcrop complex, 30 to 60 percent slopes. This complex of Morgala soil and Rock outcrop occurs on very steep south-, west- and east-facing mountainsides at elevations of 5,450 to 6,600 feet. The Morgala loam, 30 to 60 percent slopes makes up about 75 percent of the complex and Rock outcrop makes up about 15 percent. The Rock outcrop is interspersed throughout the map unit as ledges and outcroppings of bare bedrock.

Included with this complex in mapping are small areas of Norcan loam, 30 to 60 percent slopes, and Toncana loam, 40 to 60 percent slopes.

This Morgala soil is very deep and well drained. It formed in materials weathered mostly from sandstone. The slopes are medium or long in length. The average annual precipitation is about 22 inches. Mean annual air temperature is about 45 degrees F, and the frost-free season is about 75 days.

In a typical profile, the surface layer is dark reddish brown or dark red loam or clay loam about 15 inches thick. The subsoil is red clay loam to a depth of 60 inches or more. The surface layer and upper part of the subsoil are moderately calcareous and moderately alkaline. The lower part of the subsoil is strongly calcareous and moderately alkaline. Rock fragment content is about 5 percent throughout.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. The erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is Gambel oak, bluebunch wheatgrass, bearded wheatgrass, mountain snowberry, Utah snowberry, serviceberry, bigtooth maple, and some slender wheatgrass, western goldenrod, and big sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excess shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable where the range vegetation has seriously deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

The Rock outcrop is interspersed throughout the complex. It consists of bare fractured quartzite on very steep mountain slopes and canyon walls. It is more than 90 percent barren, but may support sparse amounts of bluebunch wheatgrass, muttongrass, or curlleaf mountain-mahogany, or Douglas-fir in pockets and cracks.

This complex has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

Because of very steep slopes and inaccessibility, this soil is not used for urban or recreational developments. Septic tank absorption field problems develop in some areas because of slow permeability and steep slopes.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

MwC—Moweba gravelly loam, 6 to 15 percent slopes. This Moweba soil is very deep and well drained. It occurs on alluvial fans and benches in mountainous areas at elevations of 5,500 to 7,000 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of Cumulic Haploborolls, wet, and Fluvaquentic Haploborolls and Fluventic Haploxerolls, 1 to 6 percent slopes, and areas of a very cobbly soil.

In a typical profile, the surface layer is dark reddish brown gravelly loam about 24 inches thick. The subsoil is dark red very gravelly loam about 15 inches thick. The substratum is red very gravelly loamy fine sand to a depth of 60 inches or more. This soil is neutral in the surface layer and slightly acid or neutral in the subsoil and substratum. Rock fragment content is about 25 percent in the surface layer and 60 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some big bluegrass, Nevada bluegrass, arrowleaf basamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and other plants decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. When the range vegetation has seriously deteriorated, seeding is advisable. Successful range

seeding largely depends on seedbed preparation, depth of seeding, and time of seeding. The concentration of rock fragments on the soil surface increases the difficulty of range seeding. Grasses suitable for seeding include Regar brome, smooth brome, mountain brome, orchardgrass, or Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

This soil has potential for summer home and recreational developments. The high concentration of rock fragments is a feature that limits such uses. Seepage of effluent from septic tank filter fields is a pollution hazard to water supplies.

Recreational uses are mainly hunting and snowmobiling. Capability unit VIe-M, nonirrigated.

MwG—Moweba gravelly loam, 30 to 50 percent slopes. This Moweba soil is very deep and well drained. It occurs on very steep, even and concave, dominantly north- and east-facing mountainsides. The slopes are medium or long in length. Elevations range from 6,000 to 7,600 feet. This soil formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, Charcol gravelly fine sandy loam, 30 to 50 percent slopes, and Hoskin cobbly loam, 30 to 50 percent slopes.

In a typical profile, the surface layer is very dark brown or dark reddish brown gravelly loam about 20 inches thick. The top part of the subsoil is mixed with the lower part of the surface layer. The subsoil is reddish brown or yellowish red gravelly loam, very gravelly loam, or very gravelly fine sandy loam about 34 inches thick. The substratum is yellowish red very gravelly sandy loam to a depth of 70 inches or more. This soil is slightly acid in the surface layer and medium acid in the subsoil and substratum. Rock fragment content is about 25 percent in the surface layer and 50 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some big bluegrass, Nevada bluegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. When the range vegetation has seriously deteriorated, seeding is advisable. Grasses suitable for seeding include Regar brome, smooth brome, mountain brome, orchardgrass, or Garrison meadow foxtail. Successful seeding largely depends on seedbed preparation, depth of seeding, and time of seeding. Steep slopes and rock fragments affect the seeding operation.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

Inaccessibility and very steep slopes are features that limit the use of this soil for urban or recreational developments. Seepage of effluent from septic tank filter fields is a water supply pollution hazard in this soil.

Recreational use is mainly hunting. Capability unit VIIe-M, irrigated.

MyG—Moweba-St. Marys complex, 30 to 50 percent slopes. This complex of Moweba and St. Marys soils occurs dominantly on very steep mountainsides at elevations of 6,000 to 8,000 feet. The Moweba gravelly loam, 30 to 50 percent slopes, occurs on the north- and east-facing, medium and long, smooth and concave side slopes. The St. Marys cobbly loam, 30 to 50 percent slopes, occurs on the south- and west-facing, convex, short and medium ridges and side slopes. Each of these soils makes up about 40 percent of the complex.

Included with these soils in mapping are small areas of Charcol gravelly fine sandy loam, 30 to 50 percent slopes, Hoskin cobbly loam, 30 to 50 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, and Henefer loam, 40 to 60 percent slopes.

The Moweba soil is very deep and well drained. It formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual preciptation is about 22 inches, mean annual temperature is about 43 degrees F, and the frost-free season is about 75 days.

In a typical profile, the surface layer is very dark brown gravelly loam about 30 inches thick. The subsoil is brown very gravelly loam to a depth of 65 inches or more. This soil is neutral. The rock fragment content is about 25 percent in the surface layer and about 55 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

The St. Marys soil is deep and well drained. It formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipiation

is about 22 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 80 days.

In a typical profile, the surface layer is very dark brown or dark brown cobbly loam about 14 inches thick. The subsoil is yellowish red very cobbly sandy clay loam about 10 inches thick. The substratum is yellowish red very gravelly sandy loam to a depth of 60 inches or more. This soil is neutral except for the lower part of the substratum which is slightly acid. Rock fragment content is about 40 percent in the surface layer, 55 percent in the subsoil, and 65 percent in the substratum.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

These soils are used for range, wildlife habitat, and water supply.

Potential vegetation on the Moweba soil is bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some big bluegrass, Nevada bluegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. Potential vegetation on the St. Marys soil is dominantly bluebunch wheatgrass, muttongrass, birchleaf mountainmahogany, Nevada bluegrass, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

Inaccessibility, very steep slopes, and high amount of rock fragments in these soils are features that limit their use for urban or recreational developments. Septic tank filter field effluent is a pollution hazard to water supplies in this soil.

Recreatonal use is mainly hunting. Capability unit VIIe-M, nonirrigated.

NAE—Nagitsy gravelly loam, 10 to 30 percent slopes. The Nagitsy soil is moderately deep and well drained. It occurs on southeast-facing, high mountainsides and subalpine side slopes at elevations of 7,200 to 8,200 feet. The slopes are short or medium in length. This soil formed in materials weathered from quartzite, schist, argillite, phyllite, and gneiss. The average annual precipitation is about 40 inches, mean annual air temperature is about 39 degrees F, and the frost-free season is about 35 days.

Included with this soil in mapping are small areas of Nagitsy stony loam, 50 to 70 percent slopes, Poleline stony loam, 40 to 70 percent slopes, and Rock outcrop.

In a typical profile, the surface layer is very dark brown gravelly loam about 9 inches thick. The upper part of the underlying layer is dark yellowish brown very gravelly sandy clay loam about 7 inches thick and the lower part is brown, very gravelly sandy loam about 7 inches thick. Fractured bedrock is at a depth of 23 inches. The depth to the bedrock ranges from 20 to 40 inches. This soil is slightly acid or neutral. Rock fragment content is about 35 percent in the surface layer and 50 to 80 percent in the underlying layer.

Permeability is moderate above the bedrock. Effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly slender wheatgrass, bearded wheatgrass, blue wildrye, tufted hairgrass, aster, bluebell, geranium, Louisiana sagewort, and some chokecherry, mountain snowberry, silver sagebrush, and low sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, bobcat, weasel, and badger.

Inaccessibility, very steep slopes, depth to bedrock, rock fragment content on the soil surface and in the soil are features that limit the use of this soil for urban or recreational developments. However, these soils occur on landscapes with potential for snow skiing recreational developments. Septic tank filter fields will develop problems in some areas because of very steep slopes and depth to rock.

Lateral movement of septic tank effluent over the bedrock and surfacing on the steep slopes is a possible pollution hazard to water supplies.

Recreational use of this soil is mainly hunting. Not placed in a capability unit (all in National Forest).

NcG—Nagitsy-Rock outcrop complex, 50 to 70 percent slopes. This complex of Nagitsy soil and Rock outcrop occurs on the east-facing subalpine mountainsides and canyon walls near the Morgan and Davis Counties boundary at elevations of 8,000 to 9,700 feet. The slopes are medium in length. The Nagitsy stony loam, 50 to 70 percent slopes, makes up about 60 percent of the complex, and the Rock outcrop makes up about 20 percent. The Rock outcrop is interspersed throughout the map unit as ledges and outcroppings of bare exposed bedrock.

Included with this complex in mapping are small areas of Broad Canyon stony loam, 30 to 70 percent slopes, Poleline stony loam, 40 to 70 percent slopes, and Nordic gravelly loam, 30 to 70 percent slopes.

The Nagitsy soil is moderately deep and well drained. It formed in materials weathered from schist, argillite, phyllite, gneiss, and quartzite. The average annual precipitation is about 40 inches, mean annual air temperature is about 39 degrees F, and the frost-free season is about 35 days.

In a typical profile, the surface layer is very dark grayish brown or dark brown stony loam in the upper part and gravelly loam in the lower part and is about 15 inches thick. The underlying layer is very dark grayish brown or dark brown very gravelly loam about 24 inches thick. Bedrock is at a depth of 39 inches. The depth to bedrock ranges from 23 to 39 inches. This soil is medium acid. Rock fragment content is about 35 percent in the surface layer and 50 percent in the underlying layer.

Permeability is moderate above the bedrock. Effective rooting depth is 23 to 39 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly slender wheatgrass, bearded wheatgrass, blue wildrye, tufted hairgrass, aster, bluebell, geranium, Louisiana sagewort, and some chokecherry, mountain snowberry, silver sagebrush, and low sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This complex has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, bobcat, weasel, and badger.

The Rock outcrop is interspersed throughout the complex. It consists of bare fractured argillite, phyllite, schist, gneiss, and quartzite on very steep mountainsides and canyon walls. It is more than 90 percent barren, but may support sparse amounts of tufted hairgrass, blue wildrye, curlleaf mountainmahogany, or Douglas-fir in pockets and cracks.

Inaccessibility, very steep slopes, depth to bedrock, and rock fragment content on the surface and in the soil are features that limit the use of this complex for urban or recreational developments. However, this complex occurs on landscapes that have potential for snow skiing recreational developments. Septic tank filter field problems develop in some areas because of very steep slopes and depth to bedrock. Lateral movement of the septic tank effluent over the bedrock and surfacing on the steep slopes is a source of pollution to water supplies.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

NDG—Nagitsy-Broad Canyon-Rock outcrop association, very steep. This association of Nagitsy and Broad Canyon soils and Rock outcrop occurs on subalpine slopes and high mountainsides at elevations of about 6,400 to 9,800 feet. The Nagitsy stony loam, 50 to 70 percent slopes, makes up about 30 percent of the association. It occupies east-facing convex ridges and high mountainsides, under a cover of grasses, forbs, and shrubs. The Broad Canyon stony loam, 30 to 70 percent slopes, is on short and medium, north-facing high mountainsides. It makes up about 30 percent of the association and occurs under a cover of Douglas-fir, white fir, and alpine fir. The Rock outcrop makes up about 20 percent of the association and is interspersed throughout the map unit. It occurs as ledges and outcroppings of bare exposed bedrock.

Included with this association in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes.

The Nagitsy and Broad Canyon soils in this association both formed in materials weathered from argillite, phyllite, schist, gneiss, and quartzite. The average annual precipitation is about 40 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 40 days.

The Nagitsy soil is moderately deep and well drained. In a typical profile, the surface layer is very dark grayish brown or dark brown gravelly loam about 8 inches thick. The upper part of the underlying layer is brown or dark brown, gravelly clay loam about 16 inches thick, and the lower part is yellowish brown very gravelly sandy clay loam. Bedrock is at a depth of 28 inches. The depth to bedrock ranges from 23 to 39 inches. This soil is slightly acid. Rock fragment content is about 20 percent in the surface layer and 35 to 70 percent in the underlying layers.

Permeabiity is moderate above the bedrock. Effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly slender wheatgrass, bearded wheatgrass, blue wildrye, tufted hairgrass, aster, bluebell, geranium, Louisiana sagewort, and some chokecherry, mountain snowberry, silver sagebrush, and low sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, bobcat, weasel, and badger.

Inaccessibility, very steep slopes, depth to bedrock, and rock fragment content on the surface and in the soil are soil features that limit the use of this soil for urban or recreational developments. However, Nagitsy soils occur on landscapes with potential for snow skiing recreational developments. Septic tank filter fields develop problems

on most areas because of very steep slopes and depth to bedrock. Lateral movement of septic tank effluent over the bedrock and surfacing on the steep slopes is a pollution hazard to water supplies.

Recreational use of this soil is mainly hunting.

The Broad Canyon soil is deep and well drained. In a typical profile, the surface layer is dark brown stony loam in the upper part and gravelly light clay loam in the lower part and is about 14 inches thick. The subsoil is dark yellowish brown gravelly clay loam about 10 inches thick. The substratum is brown very gravelly clay loam to a depth of 60 inches or more. The depth to bedrock ranges from 40 to 60 inches or more. This soil is medium acid. Rock fragment content is about 25 percent in the surface layer, 40 percent in the subsoil, and 60 percent in the substratum.

Permeability is moderate. Effective rooting depth is 40 to 60 inches or more. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for woodland, water supply, and wildlife habitat.

Potential vegetation is Douglas-fir, white fir, alpine fir, pine, and an understory of grasses, forbs, and chokecherry. This soil is suited for the production of Douglas-fir. It is capable of producing about 870 cubic feet or 3,400 board feet (International Rule) per acre of merchantable timber from a fully stocked, even-aged stand of 100-year-old trees. Primary restrictions in its use for timber production are slope, high content of rock fragments, and the stony soil surface. Care should be exercised in the selection of landings, skid trails, and logging roads to minimize soil losses. Plant competition will delay natural or artificial regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Use of conventional methods of tree harvest should be restricted due to the very steep slopes and stony soil surface. High lead logging method is more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, porcupine, red fox, coyote, weasel, and bobcat.

Steep slopes, inaccessibility, and high content of rock fragments are features that limit the use of Broad Canyon soils for urban and recreational developments. Pollution to water supplies is a hazard where septic tanks are installed on this soil.

This soil is important for watershed. Any recreational development or cabin sites should be carefully planned and its impact on the environment evaluated. Careful management of the timber resource and understory vegetation is essential to keep soil losses to a minimum, thus maintaining the watershed potential. Adequate provisions must be made to safeguard the trees from harmful insects and fire.

Recreational use of this soil is mainly hunting.

The Rock outcrop is interspersed throughout the association. It consists of bare, fractured argillite, phyllite, schist, gneiss, and quartzite on very steep mountainsides and canyon walls. It is more than 90 percent barren, but may support sparse amounts of tufted hairgrass, blue wildrye, curlleaf mountainmahogany, or Douglas-fir in pockets and cracks. Not placed in a capability unit (all in National Forest).

NPG—Nagitsy-Patio-Rock outcrop association, very steep. This association of Nagitsy and Patio soils and Rock outcrop occurs on very steep mountainsides and canyon walls at elevations of 5,200 to 9,000 feet. The Nagitsy stony loam, 50 to 70 percent slopes, makes up about 40 percent of the association. It occurs at the upper elevations under a cover of low sagebrush and grasses. The Patio gravelly loam, 40 to 60 percent slopes, makes up about 30 percent. It occurs at the lower elevations and on the south- and west-facing side slopes under a cover of Gambel oak and grasses. The Rock outcrop makes up about 20 percent and is interspersed throughout the association. It occurs on ridges and as ledges and exposures of bare bedrock.

Included with this association in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, and Nordic gravelly loam, 30 to 60 percent slopes.

The Nagitsy and Patio soils are moderately deep and well drained. They formed in material weathered from schist, gneiss, quartzite, argillite, and phyllite. The slopes are short or medium in length. At the upper elevations the average annual precipitation is about 40 inches, mean annual air temperature is about 39 degrees F, and the average frost-free season is about 35 days. At the lower elevations the average annual precipitation is about 25 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 85 days.

In a typical profile of the Nagitsy soil, the surface layer is very dark grayish brown stony loam in the upper part and dark brown gravelly loam in the lower part and is about 15 inches thick. The underlying layer is very dark grayish brown or dark brown very gravelly or gravelly loam about 24 inches thick. Fractured bedrock is at a depth of 39 inches. The depth to the bedrock ranges from 20 to 40 inches. This soil is medium acid. Rock fragment content is about 35 percent in the surface layer and 50 percent in the underlying layer.

Permeability is moderate above the bedrock. Effective rooting depth is 20 to 40 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

In a typical profile of the Patio soil, the surface layer is very dark brown or dark brown gravelly loam about 13 inches thick. The subsoil is dark yellowish brown very gravelly clay loam about 13 inches thick. Fractured bedrock is at a depth of 26 inches. The depth to bedrock ranges from 23 to 32 inches. This soil is slightly acid. Rock fragment content is about 40 percent in the surface layer and 55 percent in the subsoil.

Permeability is moderate above the bedrock. Effective rooting depth is 23 to 32 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The Rock outcrop is interspersed throughout the complex. It consists of bare fractured argillite, phyllite, schist, gneiss, and quartzite on very steep mountainsides and canyon walls. It is more than 90 percent barren, but may support sparse amounts of tufted hairgrass, blue wildrye, curlleaf mountainmahogany, or Douglas-fir in pockets and cracks.

Rock outcrop areas have esthetic value and are used with the Nagitsy and Patio soils for wildlife habitat.

This association is used mainly for range, water supply, and wildlife habitat.

Potential vegetation for the Nagitsy soil is slender wheatgrass, bearded wheatgrass, blue wildrye, tufted hairgrass, aster, bluebell, geranium, Louisiana sagewort, and some chokecherry, mountain snowberry, silver sagebrush, and low sagebrush. The potential vegetation for the Patio soil is bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, birchleaf mountainmahogany, mountain snowberry, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

The soils in this association have potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. They also are potential habitat for ruffed grouse, blue grouse, snowshoe hare, cottontail rabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

Inaccessibility, very steep slopes, depth to bedrock, and rock fragment content on the soil surface and in the soil are features that limit the use of the soils in this association for urban or recreational developments.

The soils in this association are important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Not placed in a capabiity unit (all in National Forest).

NrA—Nebeker clay loam, 0 to 3 percent slopes. This Nebeker soil is very deep and well drained. It occurs on nearly level and gently rolling terraces at elevations of 4,900 to 5,150 feet. The slopes are short, medium, and long in length. This soil formed in mixed lake sediments. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Nebeker clay loam, 3 to 6 percent slopes, Hawkins silty clay, 3 to 6 percent slopes, Parleys loam, high rainfall, 0 to 3 percent slopes, and Eastcan variant loam, 6 to 10 percent slopes.

In a typical profile, the surface layer is very dark brown clay loam about 20 inches thick. The subsoil is dark reddish brown or reddish brown clay in the upper part and yellowish red, sandy clay loam or clay loam to a depth of 69 inches or more. The surface layer and the upper part of the subsoil are slightly acid, and the lower part of the subsoil is moderately calcareous and moderately alkaline.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Principal crops grown are alfalfa, pasture, corn for silage, and small grains.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Border irrigation is used on alfalfa, small grains, and pasture. Land leveling is necessary in some areas to obtain an even distribution of irrigation water. Irrigation applications and intervals should be adjusted to crop needs and the available water capacity and water intake rate. Stream sizes should not cause soil movement in furrows, corrugations, and borders. The length of irrigation runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These irrigation practices help control soil erosion and excessive leaching of plant nutrients. Pipes, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail and jackrabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is used for homesites. Slow permeability, clay loam surface layer, clay subsoil, and limited ability to support a load are the soil features that limit the use of this soil for homesites. Dwellings and roads can be designed and modified to offset the limited ability to support a load. Climatically adapted grasses, shrubs, and trees for beautification grow well on Nebeker soils.

Septic tank absorption field problems are likely to develop because of the slow permeability of this soil. Contamination of the ground water supply is a hazard where cesspools are installed.

Recreational use of this soil is mainly snowmobiling. Capability unit IIc-2, irrigated.

NrB—Nebeker clay loam, 3 to 6 percent slopes. This Nebeker soil is very deep and well drained. It occurs on sloping terraces and alluvial fans at elevations of 4,950 to 5,150 feet. The slopes are short, medium, and long in length. This soil formed in alluvium or lake sediments. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Nebeker clay loam, 0 to 3 percent slopes, Eastcan variant loam, 6 to 10 percent slopes, and Eastcan loam, 0 to 3 percent slopes.

In a typical profile, the surface layer is very dark brown clay loam about 8 inches thick. The subsoil is very dark brown clay loam to a depth of 60 inches or more. This soil is slightly acid.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Principal crops grown are alfalfa, pasture, corn for silage, and small grains.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help control erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop grown. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Border irrigation is adapted to alfalfa, small grains, and pasture. Regardless of the irrigation method used, water should be applied carefully to avoid soil erosion on the steeper slopes. Irrigation applications should be adjusted to crop needs and the available water capacity and water intake rate to prevent overirrigation and leaching of plant nutrients. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for ring-necked pheasant, mourning dove, Hungarian partridge, cottontail and jackrabbit, skunk, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelters that protect the birds from predators and inclement weather.

This soil is used for homesites. Slow permeability, clay loam surface layer, clay subsoil, and limited ability to support a load are soil features that limit its use for urban and recreational developments. Dwellings and road designs can be modified to offset the limited ability to support a load. Adapted grasses, shrubs, and trees for beautification grow well. Septic tank absorption fields develop problems because of slow permeability. Contamination of the ground water supply is a hazard when cesspools are used.

Recreational use of this soil is mainly snowmobiling. Capability unit IIe-2, irrigated.

NsA—Nicodemus gravelly loam, 0 to 3 percent slopes. This soil is very deep and moderately well drained. It occurs on nearly level and gently sloping flood plains or stream terraces at elevations of 4,900 to 5,350 feet. The slopes are long in length. This soil formed in alluvium weathered from argillite, phyllite, schist, and some quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Trojan loam, warm, 0 to 3 percent slopes, Cumulic Haploborolls, wet, Fluvaquentic Haploborolls and Fluventic Haploxerolls, 1 to 6 percent slopes, and areas of cobbly or very cobbly loam soils.

In a typical profile, the surface layer is very dark grayish brown gravelly loam in the upper part and very dark grayish brown or dark brown gravelly or cobbly clay loam in the lower part and is about 22 inches thick. The underlying layer is very gravelly loamy sand to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 25 percent in the upper part of the surface layer, about 40 percent in the lower part, and about 70 percent in the underlying layer. Depth to the seasonal high water table ranges from 24 to 48 inches. Flooding from nearby streams during the spring is an occasional hazard.

Permeability is moderate in the surface layer and rapid in the underlying layers. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated improved pasture, alfalfa, or small grains. Some small areas are used for range.

A suitable crop rotation is 6 to 8 years of alfalfa, and 2 to 3 years of small grains. Crop residue use, weed control, and minimum tillage are practices that help reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Border, corrugation, and sprinkler irrigation methods are suitable

for this soil. These systems are well suited to the crops normally grown on this soil. Sprinkler irrigation is desirable because the distribution and application of irrigation water can be controlled with higher efficiency. Irrigation applications should be adjusted to the crop needs, available water capacity, and water intake rate to avoid overirrigation and leaching of plant nutrients. Pipes or ditch lining should be installed to facilitate irrigation and prevent water losses by seepage. Some small areas have a large amount of rock fragments on the soil surface, which impairs operation of tillage equipment. Broadcast seeding may be desirable to improve plant cover and increase forage production on areas with excess rock fragments on the surface. Grasses suitable for seeding include smooth brome, Regar brome, orchardgrass, and alfalfa.

Potential vegetation is dominantly narrowleaf cottonwood, blue wildrye, willow, muttongrass, mountain brome, bearded wheatgrass, slender wheatgrass, and some sweetanise and water birch. When changes occur in the potential vegetation composition due to use by livestock wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Seeding may be advisable if the plant composition has severely deteriorated. Species suitable for seeding include alfalfa, smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for chukar, sharp-tailed grouse, mourning dove, Hungarian partridge, cottontail and jackrabbit, bobcat, porcupine, and skunk. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

The seasonal high water table and hazard of flooding from nearby streams, the high content of rock fragments, and the very gravelly loamy sand underlying layer are soil features that limit the use of this soil for urban or recreational developments. Effluent from septic tank filter fields are a potential pollution hazard to water supplies.

Recreational uses are mainly hunting, snowmobiling, camping and picnicking. Capability unit IVs-2, irrigated.

NtG—Norcan loam, 30 to 60 percent slopes. This Norcan soil is very deep and well drained. It occurs on very steep, dominantly north- and east-facing, concave mountainsides at elevations of 5,200 to 7,500 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Morgala loam, 30 to 60 percent slopes, Henhoit gravelly loam, 30 to 60 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, Ostler loam, 20 to 50 percent slopes, Henefer loam, 40 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown or dark red clay loam, clay, or silty clay loam to a depth of 60 inches or more. This soil is neutral.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is Gambel oak, bluebunch wheatgrass, bearded wheatgrass, Utah snowberry, mountain snowberry, and serviceberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the plant composition has severely deteriorated. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, porcupine, red fox, coyote, bobcat, weasel, and badger.

The very steep slopes and inaccessibility are features that limit the use of this soil for urban and recreational development. This soil has limited ability to support a load for dwellings and roads. However, dwellings and roads can be designed to offset this soil feature. Care should be taken when disturbing the soil on steep slopes because of the susceptibility to hillside slippage. Septic tank absorption field problems will develop in some places because of slow permeability and very steep slopes.

This soil is important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining its watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

NuG—Nordic gravelly loam, 30 to 60 percent slopes. This Nordic soil is very deep and well drained. It occurs dominantly on north- and east-facing, very steep, concave side slopes at elevations of 5,200 to 7,000 feet (fig. 9). The slopes are medium and long in length. This soil formed in materials weathered from argillite, phyllite, schist, and quartzite. The average annual precipitation is about 30 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 80 days.

Included with this soil in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, Patio

gravelly loam, 40 to 60 percent slopes, and Smarts loam, 40 to 60 percent slopes.

In a typical profile, the surface layer is very dark grayish brown gravelly loam about 15 inches thick. The subsurface layer is dark yellowish brown gravelly loam about 25 inches thick. The subsoil is strong brown gravelly or very gravelly clay loam about 18 inches thick. The substratum is brown very cobbly loam to a depth of 70 inches or more. This soil is slightly acid. Rock fragment content is about 20 percent in the surface layer, 40 percent in the subsurface layer, 60 percent in the subsoil, and 70 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bigtooth maple, Gambel oak, blue wildrye, chokecherry, mallow ninebark, and some bearded wheatgrass, mountain brome, slender wheatgrass and aster. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer during the spring, summer, and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

This soil is used for cabin sites and ski runs. The very steep slopes and high content of rock fragments are soil features that limit the use of this soil for urban or recreational developments. Septic tank absorption field problems will develop in some places because of moderately slow permeability and very steep slopes.

Recreational uses are mainly hunting, cabin sites, and skiing. Capability unit is VIIe-H, nonirrigated.

NVG—Nordic-Patio association, very steep. This association of Nordic and Patio soils occurs dominantly on very steep mountainsides at elevations of 5,500 to 7,000 feet. Nordic gravelly loam, 30 to 60 percent slopes, makes up about 40 percent of the association. It occurs on medium and long, slightly concave, north- and east-facing mountainsides under a cover of bigtooth maple and grasses. Patio gravelly loam, 40 to 60 percent slopes, makes up about 30 percent of the association. It occurs on medium and long, slightly convex, south- and east-facing mountainsides under a cover of Gambel oak and grasses.

Included with these soils in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes.

This Nordic soil is very deep. The Patio soils are moderately deep. Both soils are well drained. They formed in materials weathered from argillite, phyllite, schist, and quartzite. The average annual precipitation is about 25 inches. The mean annual air temperature is about 44 degrees F, for the Nordic soil and 45 degrees F for the Patio soil. The average frost-free season is about 80 days.

In a typical profile of the Nordic soil, the surface layer is very dark grayish brown gravelly loam about 15 inches thick. The subsurface layer is dark yellowish brown gravelly loam about 25 inches thick. The subsoil is strong brown gravelly or very gravelly clay loam about 18 inches thick. The substratum is brown very cobbly loam to a depth of 70 inches or more. This soil is slightly acid. Rock fragment content is about 20 percent in the surface layer, 40 percent in the subsurface layer, 60 percent in the subsoil, and 70 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

In a typical profile of the Patio soil, the surface layer is very dark brown gravelly loam in the upper part and dark brown gravelly clay loam in the lower part and is about 16 inches thick. The subsoil is cobbly clay loam to a depth of about 35 inches. The depth to bedrock ranges from 20 to 35 inches. This soil is neutral in the surface layer and slightly acid in the subsoil. Rock fragment content is about 25 percent in the upper part of the surface layer and 50 percent in the lower part and is 70 percent in the subsoil.

Permeability is moderate above the bedrock. Effective rooting depth is 20 to 35 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The soils in this association are used for range, wildlife habitat, and water supply.

The potential vegetation for the Nordic soil is dominantly bigtooth maple, blue wildrye, chokecherry, mallow ninebark, Gambel oak, and some mountain brome, slender wheatgrass, and aster. The potential vegetation for the Patio soil is dominantly bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, birchleaf mountainmahogany, mountain snowberry, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

These soils have potential for supporting plants that provide food and cover for mule deer during the spring, summer, and fall. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

The very steep slopes and high rock fragment content in both soils and moderate depth to bedrock in the Patio soil are features that limit use for urban or recreational

developments. Septic tank filter field problems develop in places because of moderately slow permeability in the Nordic soil and the moderate depth to bedrock in the Patio soil. Water supply pollution is a hazard when these soils are used for septic tank filter fields.

The soils in this association are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Not placed in a capability unit (all in National Forest).

OaG—Ostler loam, 20 to 50 percent slopes. This Ostler soil is very deep and well drained. It occurs on all aspects, but is dominantly on north- and east-facing, very steep foothills. The slopes are medium or long in length. Elevation ranges from 5,200 to 6,700 feet. This soil formed in materials weathered from tuffaceous sandstone and tuffaceous siltstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 85 days.

Included with this soil in mapping are small areas of Bertag silt loam, 30 to 50 percent slopes, Hawkins silty clay, 6 to 15 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, and Causey silt loam, 30 to 60 percent slopes.

In a typical profile, the surface layer is black or very dark brown loam about 18 inches thick. The subsoil is dark brown and light olive brown clay or clay loam in the upper part and is dark yellowish brown sandy clay loam in the lower part and is about 31 inches thick. The substratum is light brownish gray clay loam to a depth of 60 inches or more. The surface layer is slightly acid and the subsoil and substratum are medium acid.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly Gambel oak, bluebunch wheatgrass, bearded wheatgrass, bigtooth maple, mountain snowberry, serviceberry, Utah snowberry, and some slender wheatgrass and western goldenrod. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Brush management is practical on areas with excessive shrubs if a reasonable understory of desirable grasses and forbs is present. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired vegetation composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, fall, and summer. It also is potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, badger, porcupine, and red fox.

This soil has potential for urban and recreational developments. Steep and very steep slopes and limited ability to support a load are soil features that limit use for urban and recreational developments. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken in disturbing the soil on the steep slopes because of the susceptibility to hillside slippage. Septic tank absorption field problems will develop in some areas because of slow permeability. Vegetated slip scars and deep active gullies occur throughout the delineated areas of this soil.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

OcG—Ostler-Causey complex, 20 to 60 percent slopes. This complex of Ostler and Causey soils occurs on very steep foothills at elevations of 5,200 to 6,500 feet. The Ostler loam, 20 to 50 percent slopes, makes up about 55 percent of the complex. It occurs dominantly on the north- and east-facing, concave, medium and long side slopes. The Causey silt loam, 30 to 60 percent slopes, makes up about 30 percent of the complex. It occurs dominantly on the south- and west-facing, convex, short side slopes.

Included with this complex in mapping are small areas of Hawkins silty clay, 6 to 15 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, Choptie silt loam, 30 to 60 percent slopes, and Bertag silt loam, 30 to 50 percent slopes.

Both the Ostler and Causey soils are deep and well drained. They formed in materials weathered from tuffaceous sandstone and tuffaceous siltstones. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 90 days.

In a typical profile of the Ostler soil, the surface layer is very dark brown loam about 10 inches thick. The subsoil is dark brown or light olive brown silty clay about 38 inches thick. Weathered tuffaceous sandstone is at a depth of 48 inches. The depth to the sandstone ranges from 48 to more than 60 inches. The surface layer is slightly acid and the substratum is medium acid. Rock fragment content is about 40 percent soft gravel in the lower part of the subsoil.

Permeability is slow. Effective rooting depth is 48 to more than 60 inches. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

In a typical profile of the Causey soil, the surface layer is very dark brown or very dark grayish brown silt loam about 19 inches thick. The upper part of the underlying layer is dark grayish brown loam about 21 inches thick, and the lower part is pale brown gravelly loam or very gravelly loam to a depth of 63 inches or more. The surface layer is generally noncalcareous, but it is slightly or moderately calcareous in places. A layer of strong lime accumulation is in the underlying layer. Bedrock occurs at a depth of 48 to more than 60 inches.

Permeability is moderate. Effective rooting depth is 48 to more than 60 inches. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

The Ostler and Causey soils are used for range, water supply, and wildlife habitat.

Potential vegetation for the Ostler soil is dominantly Gambel oak, bluebunch wheatgrass, bearded wheatgrass, bigtooth maple, serviceberry, Utah snowberry, mountain snowberry, and some slender wheatgrass and western goldenrod. The potential vegetation for the Causey soil is dominantly bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some arrowleaf balsamroot, antelope bitterbrush and mountain snowberry. When changes occur in the potential vegetation due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. If the range vegetation has seriously deteriorated, range seeding is practical on the Causey soil. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during spring, summer, and fall. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, weasel, badger, porcupine, and red fox.

The Ostler soil has potential for urban and recreational developments. Dwellings and roads can be designed to offset the limited ability to support a load. Care should be taken when disturbing this soil on the steep slopes because of the susceptibility to hillside slippage. Septic tank absorption field problems develop in some places because of slow permeability. Vegetated slip scars and deep active gullies occur throughout this complex.

The very steep slope is the soil feature that limits the use of the Causey soil for urban or recreational developments.

Both soils are important for watershed. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of these soils is mainly hunting. Capability unit VIIe-M, nonirrigated.

ODG—Ostler-Bertag association, very steep. This association of Ostler and Bertag soils occurs dominantly on moderately steep or steep foothills and mountainsides at elevations of 5,200 to 7,600 feet. Ostler loam, 20 to 50 percent slopes, makes up about 50 percent of the association. It occurs on the medium and long, slightly convex, south- and west-facing side slopes under a cover of oak and grasses. The Bertag silt loam, 30 to 50 prcent slopes, makes up about 30 percent of the association. It occurs on medium and long, slightly concave, north- and east-facing side slopes under a cover of maple and grasses.

Included with these soils in mapping are small areas of Hawkins silty clay, 6 to 15 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, and Causey silt loam, 30 to 60 percent slopes.

The Ostler and Bertag soils are very deep and well drained. They formed in materials weathered from tuffaceous sandstone and limestone. The average annual precipitation is about 24 inches. The mean annual air temperature is about 44 degrees F. The average frost-free season is about 80 days. The slopes are short or medium in length.

In a typical profile of the Ostler soil, the surface layer is black or very dark brown loam about 18 inches thick. The subsoil is dark brown or light olive brown clay or clay loam in the upper part, and dark yellowish brown sandy clay loam in the lower part and is about 31 inches thick. The substratum is light brownish gray clay loam to a depth of 60 inches or more. The surface layer is slightly acid and the subsoil and substratum are medium acid.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is medium. Erosion hazard is high.

In a typical profile of the Bertag soil, the surface layer is black loam in the upper part and very dark brown clay loam in the lower part and is about 18 inches thick. The subsoil is dark brown or brown clay to a depth of 60 inches or more. This soil is slightly acid.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

The soils in this association are used mainly for range, water supply, and wildlife habitat.

Potential vegetation for the Ostler soil is dominantly Gambel oak, bluebunch wheatgrass, bearded wheatgrass, bigtooth maple, mountain snowberry, serviceberry, Utah snowberry, and some slender wheatgrass and western goldenrod. Potential vegetation for the Bertag soil is dominantly bluebunch wheatgrass, bearded wheatgrass, basin wildrye, Gambel oak, slender wheatgrass, muttongrass, bigtooth maple, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, badger, porcupine, and red fox.

These soils have potential for cabin sites and other recreational developments. Dwellings and roads can be designed to offset the limited ability to support of a load. Care should be taken when disturbing the soil on steep slopes because of the susceptibility to hillside slippage. Vegetated slip scars and deep active gullies occur throughout this association. Septic tank absorption fields develop problems in some areas because of slow permeability and very steep slopes.

The soils in this association are important for watershed. Adequate plant cover should be maintained to

keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Not placed in a capability unit (all in National Forest).

PaA—Parleys loam, high rainfall, 0 to 3 percent slopes. This Parleys soil is very deep and well drained. It occurs on nearly level and gently sloping lake terraces, stream terraces, and alluvial fans at elevations of 4,900 to 5,150 feet. The slopes are short or medium in length. This soil formed in lake sediments or alluvium. The average annual precipitation is about 20 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Phoebe fine sandy loam, 0 to 3 percent slopes, Stoda loam, 10 to 25 percent slopes, Nebeker clay loam, 0 to 3 percent slopes, Parlo loam, 0 to 3 percent slopes, and Eastcan loam, 0 to 3 percent slopes.

In a typical profile, the surface layer is very dark grayish brown loam about 13 inches thick. The subsoil is very dark brown or dark brown silty clay loam or clay loam about 19 inches thick. The substratum is dark brown, brown, or strong brown silty clay loam or loam to a depth of 60 inches or more. The surface layer and subsoil are slightly acid. The substratum is moderately alkaline and strongly calcareous. There is a strong lime accumulation in the upper part of the substratum.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated and nonirrigated crops. Principal irrigated crops are alfalfa, pasture, corn for silage, and small grains.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are comonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is suited to most crops. The furrow and corrugation methods are suited to row crops. Border irrigation is suited to alfalfa, small grains, and pasture. Land leveling is necessary in places to obtain an even distribution of irrigation water. Irrigation applications should be adjusted to crop needs, available water capacity, and infiltration rate. Irrigation streams should not cause soil movement in furrows, corrugations, and borders. Length of irrigation runs should be adjusted so that water reaches the end of field without overirrigating the upper part. These practices help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

When used for nonirrigated crops, this soil can be used in a continuous cropping system. Winter wheat produces higher yields on this soil than spring wheat varieties. Some areas are planted to pubescent or intermediate wheatgrass and Ladak alfalfa for hay and pasture. This soil should be in alfalfa or pasture about 25 percent of the time to maintain soil tilth and water intake rate. Fertilizer applications should be in agreement with the crop needs, soil tests, and State experiment station recommendations. Soil erosion can be reduced if fall grain is seeded early and stubble mulch tillage is used. All tillage practices should be either on the contour or across the slope to slow the rate of runoff and reduce erosion during periods of rapid snowmelt or high rainfall intensity.

This soil has potential for supporting plants that provide food and cover for ring-necked pheasant, mourning dove, Hungarian partridge, cottontail and jackrabbit, skunk, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

Some areas of this soil are used for homesites. Dwellings and road designs can be modified to offset the limited ability to support a load. Climatically adapted grasses, shrubs, and trees for beautification grow well on this soil.

Septic tank absorption field problems will develop in some areas because of slow permeability. Contamination of the ground water supply is a hazard if cesspools are used.

Recreational use of this soil is mainly snowmobiling. Capability units IIc-2, irrigated, and IIc-M, nonirrigated.

PcA—Parlo loam, 0 to 3 percent slopes. This Parlo soil is very deep and well drained. It occurs on nearly level and gently sloping stream terraces at elevations of 5,000 to 5,100 feet. The slopes are long. This soil formed in alluvium from sandstone, quartzite, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Nebeker clay loam, 0 to 3 percent slopes, Eastcan loam, 0 to 3 percent slopes, Parleys loam, high rainfall, 0 to 3 percent slopes, and Steed loam, 0 to 1 percent slopes.

In a typical profile, the surface layer is very dark brown or dark brown loam about 19 inches thick. The subsoil is dark brown loam about 12 inches thick. The substratum is brown, reddish brown, or dark brown. The upper part is gravelly loam and the lower part is very gravelly loamy sand, very gravelly loamy fine sand, or very gravelly sand to a depth of 70 inches or more. The surface layer and subsoil are neutral. The substratum is moderately or strongly calcareous and moderately or mildly alkaline. A layer of strong lime accumulation is in

the lower part of the subsoil or the upper part of the substratum. Rock fragment content is about 70 percent in the substratum.

Permeability is moderately slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for homesites and other urban and recreational developments. Some small areas are used for irrigated crops of small grains and alfalfa. Homesite gardens are common.

When this soil is used for irrigated crops, a suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to reduce erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally, all crops respond to nitrogen fertilizers and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are suitable for row crops. Border irrigation is adapted to alfalfa, small grains and pasture. Land leveling is needed in some places to obtain an even distribution of irrigation water. Irrigation applications should be in agreement with crop needs, available water capacity, and infiltration rate. Irrigation streams should not cause soil movement in furrows, corrugations, and borders. Length of runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These practices will help control erosion and leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is well suited for homesites and other urban and recreational developments. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption field problems will develop in some areas because of moderately slow permeability. However, if tile lines are placed in the substratum septic tanks will work well, but the effluent is a pollution hazard to water supplies. Capability unit IIc-2, irrigated.

PdG—Patio gravelly loam, 40 to 60 percent slopes. This Patio soil is moderately deep and well drained. It occurs dominantly on south-, west-, and east-facing mountainsides. Elevations range from 5,200 to 7,000 feet. The slopes are short and medium in length. This soil formed in materials weathered from argillite, phyllite, and schist. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 85 days.

Included with this soil in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, Smarts loam, 40 to 60 percent slopes, Nordic gravelly loam, 30 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown or dark brown gravelly loam about 13 inches thick. The subsoil is dark yellowish brown very gravelly clay loam about 13 inches thick. Fractured argillite and phyllite are at a depth of 26 inches. The depth to bedrock ranges from 23 to 32 inches. This soil is slightly acid. Rock fragment content is about 40 percent in the surface layer and 55 percent in the subsoil.

Permeability is moderate. Effective rooting depth is about 23 to 32 inches. The available water capacity is low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, Idaho fescue, oniongrass, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, mountain snowberry, and birchleaf mountainmahogany. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, mourning dove, cottontail rabbit, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Inaccessibility, steep slopes, rock fragment content, and depth to bedrock are soil features that limit the potential of this soil for urban developments. Septic tank absorption field problems develop in some places because of steep slopes and depth to bedrock. Where septic tank absorption fields are close to streams, water supply pollution is a hazard.

This soil is important for watershed but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

PhA—Phoebe fine sandy loam, 0 to 3 percent slopes. This Phoebe soil is very deep and well drained. It occurs on nearly level terraces at elevations of about 5,000 feet. This soil formed in alluvium from sandstone, quartzite,

and limestone. The slopes are long. The average annual precipitation is about 20 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Parleys loam, high rainfall, 0 to 3 percent slopes, Eastcan loam, 0 to 3 percent slopes, and areas of Phoebe fine sandy loam, 3 to 10 percent slopes.

In a typical profile, the surface layer is very dark brown fine sandy loam in the upper part and dark brown fine sandy loam in the lower part and is about 19 inches thick. The subsoil is brown fine sandy loam about 27 inches thick. The substratum is stratified yellowish red or brown silty clay loam and brown loamy fine sand to a depth of 60 inches or more. This soil is neutral. Mottles occur at a depth of about 46 inches.

Permeability is moderately rapid. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is moderate.

The soil is used mainly for irrigated crops. Alfalfa, hay or pasture, corn for silage, and grain are the principal crops.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth and water intake rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are suited to row crops. Border irrigation is suited to alfalfa, small grains, and pasture. Land leveling is needed in some areas to obtain an even distribution of irrigation water. Irrigation applications should be adjusted to crop needs, available water capacity, and infiltration rate. Irrigation streams should not cause soil movement in furrows, corrugations, and borders. Length of runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These practices help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is suited for homesites and other urban and recreational developments. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption field problems develop in some areas because of the silty clay loam strata in the substratum.

Recreational uses of this soil are mainly snowmobiling and hunting. Some areas are adjacent to Pineview Reservoir and may be used for camp grounds to facilitate boating, fishing, water skiing, and swimming. Capability unit IIc-2, irrigated.

PoG—Poleline stony loam, 40 to 70 percent slopes. This Poleline soil is deep and well drained. It occurs on all aspects, but dominantly on north- and east-facing, concave, very steep high mountainsides. Elevations range from 5,700 to 9,000 feet. The slopes are medium and long in length. This soil formed in materials weathered from schist, argillite, phyllite, gneiss, and quartzite. The average annual precipitation is about 30 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 60 days.

Included with this soil in mapping are small areas of Patio gravelly loam, 40 to 60 percent slopes, Nordic gravelly loam, 30 to 60 percent slopes, Broad Canyon stony loam, 30 to 70 percent slopes, Nagitsy stony loam, 50 to 70 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is dark brown stony loam in the upper part and gravelly silt loam or gravelly loam in the lower part and is about 24 inches thick. The subsoil is dark brown very gravelly loam about 24 inches thick. Fractured phyllite is at a depth of 48 inches. Depth to the bedrock ranges from 48 to more than 60 inches. This soil is slightly acid in the upper part of the surface layer and medium acid in the lower part and in the subsoil. Rock fragment content is about 20 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 48 to 60 inches or more. The available water capacity is low or moderately low. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bigtooth maple, blue wildrye, chokecherry, mallow ninebark, Gambel oak, and some mountain brome, bearded wheatgrass, slender wheatgrass, and aster. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. It also is potential habitat for sage grouse, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams through the area are potential habitat for beaver.

Inaccessibility, very steep slopes, and high content of rock fragments are features that limit the use of this soil for urban or recreational developments.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

PPG—Poleline-Patio association, very steep. This association of Poleline and Patio soils occurs dominantly on very steep, high mountainsides at elevations of 5,200 to 9,000 feet. Poleline stony loam, 40 to 70 percent slopes, makes up about 50 percent of the association. It occurs on the slightly concave, north- and east-facing side slopes. The slopes are medium and long in length. This soil occurs under a cover of shrubs and grasses. The Patio gravelly loam, 40 to 60 percent slopes, makes up about 30 percent of the association. It occurs on the convex, south-facing mountainsides under a cover of Gambel oak and grasses. Slopes are short and medium.

Included with these soils in mapping are small areas of Nordic gravelly loam, 30 to 60 percent slopes, Broad Canyon stony loam, 30 to 70 percent slopes, Nagitsy gravelly loam, 10 to 30 percent slopes, Nagitsy stony loam, 50 to 70 percent slopes, and Rock outcrop.

These soils formed in materials weathered from schist, argillite, phyllite, granitic gneiss, and some quartzite. The average annual precipitation ranges from about 24 to 40 inches. The mean annual air temperature ranges from about 41 degrees to 44 degrees F. The average frost-free season is about 60 to 85 days.

This Poleline soil is deep and well drained. In a typical profile, the surface layer is dark brown stony loam in the upper part and gravelly silt loam or very gravelly loam in the lower part and is about 24 inches thick. The subsoil is very gravelly loam about 24 inches thick. Fractured phyllite is at a depth of 48 inches. Depth to the bedrock ranges from 48 to more than 60 inches. This soil is slightly acid in the upper part and medium acid in the lower part of the surface layer and subsoil. Rock fragment content is about 20 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 48 to more than 60 inches. The available water capacity is low or moderately low. Surface runoff is slow. Erosion hazard is high.

The Patio soil is moderately deep and well drained. In a typical profile, the surface layer is very dark brown or dark brown gravelly loam about 13 inches thick. The subsoil is dark yellowish brown, very gravelly clay loam about 13 inches thick. Fractured bedrock is at a depth of 26 inches. The depth to bedrock ranges from 23 to 32 inches. This soil is slightly acid. Rock fragment content is about 40 percent in the surface layer and 55 percent in the subsoil.

Permeability is moderate above the bedrock. Effective rooting depth is 23 to 32 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The soils in this association are used mainly for range, water supply, and wildlife habitat.

Potential vegetation for the Poleline soil is dominantly bigtooth maple, blue wildrye, chokecherry, mallow ninebark, Gambel oak, and some mountain brome, bearded wheatgrass, slender wheatgrass, and aster. Potential vegetation for the Patio soil is dominantly bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, birchleaf mountainmahogany, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. They also are potential habitat for sage grouse, sharp-tailed grouse, chukar, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

The very steep slopes and high rock fragment content of both soils and depth to bedrock in the Patio soil are soil features that limit the use of these soils for urban or recreational developments. Effluent from septic tank filter fields in these soils is a water supply hazard.

The soils in this association are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of the soils in this association are mainly hunting and snow skiing. Not placed in a capability unit (all in National Forest).

PrA—Pringle loam. This Pringle soil is very deep and somewhat poorly drained. It occurs on nearly level flood plains, valley bottoms, and stream terraces at elevations of 4,800 to 5,500 feet. Slope is 0 to 1 percent. The slopes are medium or long in length. This soil formed in alluvium from sandstone, quartzite, and limestone. The average annual precipitation is about 19 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Sunset loam, very gravelly substratum, Canburn silt loam, Cumulic Haploborolls, wet, Eastcan loam, 0 to 3 percent slopes, Utaba cobbly loam, warm, and Utaba loam, warm.

In a typical profile, the surface layer is very dark grayish brown or dark brown loam in the upper part and stratified silt loam and very fine sandy loam in the lower part and is about 19 inches thick. The underlying layer is dark brown very gravelly sand to a depth of 60 inches or more. This soil is moderately calcareous and mildly alkaline. Rock fragment content is about 60 percent in the underlying layer. Mottles are common in the lower part of the surface layer and in the underlying layer. Depth to the seasonal high water table ranges from 1.0 to 2.0 feet unless the soil is drained. Flooding from nearby streams is common during the late winter and spring during periods of rapid snowmelt. In an area south of Mountain

Green and adjacent to the Weber River the surface layer is 6 to 10 inches thick.

Permeability is moderate in the surface layer and rapid in the underlying layer. Intake rate is rapid. Effective rooting depth is mainly above the water table, but roots extend throughout the profile. The available water capacity is moderately low. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops and improved pasture. Principal crops grown are small grains and alfalfa.

A suitable crop rotation for the better drained areas is 4 years of alfalfa, 2 years of small grains, and 1 year of small grains with alfalfa planted in the stubble. Maintaining a good stand of alfalfa is difficult because of the seasonal high water table. Crop residue use, weed control, and minimum tillage are practices that help control erosion and maintain favorable tilth and infiltration rate. Some of this soil is used for native pasture and grass hay. Improved plant species such as Garrison meadow foxtail, reed canarygrass, and red clover are recommended to increase forage production. Pastures should be managed and fertilized to keep plants in a vigorous and healthy condition. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border, corrugation, and sprinkler irrigation methods are suitable for this soil. Sprinkler irrigation allows even distribution and control of irrigation water application. Border irrigation is suited to alfalfa, small grains, and pasture. Land leveling is necessary in places to obtain an even distribution of irrigation water. Land leveling cuts of more than 12 to 15 inches that would expose the underlying very gravelly sand should be avoided. Irrigation applications should be adjusted to crop needs, available water capacity, and infiltration rate. The size of streams should not cause soil movement in the corrugations or borders. Length of irrigation runs should be adjusted so that the water reaches the end of the field without overirrigating the upper portion. These practices will help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for ring-necked pheasant, Hungarian partridge, mourning dove, chukar, cottontail and jackrabbit, porcupine, and skunk. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

The depth to the seasonal high water table and flooding are features that limit the use of this soil for homesites and other urban and recreational developments. Septic tank absorption fields will develop problems because of the flooding and seasonal high water table.

Recreational uses of this soil are mainly hunting and snowmobiling. The Weber River runs through some areas and provides fishing. Capability unit IIIw-3, irrigated.

RaG—Redcan-Etchen complex, 25 to 60 percent slopes. This complex of Redcan and Etchen soils occurs dominantly on very steep, south-facing mountainsides at elevations of 6,500 to 7,000 feet. Redcan cobbly loam, 40 to 60 percent slopes, makes up about 55 percent of the complex. It occurs on the convex slopes and ridges. Slopes are short and medium in length. The Etchen very cobbly loam, 25 to 50 percent slopes, makes up about 30 percent. It occurs on the moderately steep, concave foot slopes. Slopes are medium and long in length.

Included within this complex in mapping are small areas of Rock outcrop and Hoskin cobbly loam, 50 to 70 percent slopes.

The Redcan and Etchen soils formed in materials weathered from sandstone and shale. The average annual precipitation is about 18 inches, mean annual air temperature is about 40 degrees F, and the frost-free season is about 75 days.

The Redcan soil is shallow and well drained. In a typical profile, the surface layer is dark red cobbly loam about 2 inches thick. The underlying layer is dark red or red cobbly loam or very gravelly loam. Weathered shale is at a depth of 15 inches. The depth to the shale ranges from 15 to 20 inches. This soil is strongly calcareous and moderately alkaline. Rock fragment content is about 25 percent in the surface layer and 60 percent in the underlying layer.

Permeability is moderate above the bedrock. Effective rooting depth is 15 to 20 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

The Etchen soil is moderately deep and well drained. In a typical profile, the surface layer is dark reddish brown or reddish brown cobbly loam about 8 inches thick. The subsoil is yellowish red cobbly or very cobbly sandy clay loam about 21 inches thick. The substratum is red very cobbly loam about 5 inches thick. Fractured sandstone bedrock is at a depth of 34 inches. The depth to sandstone bedrock ranges from 21 to 38 inches. This soil is mildly alkaline and slightly or moderately calcareous in the surface layer. The subsoil and substratum are moderately alkaline and moderately or strongly calcareous. Rock fragments cover about 60 percent of the soil surface. Rock fragment content is about 40 percent in the surface layer, 50 percent in the subsoil, and 70 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 21 to 38 inches. The available water capacity is low. Surface runoff is medium. Erosion hazard is high.

The soils in this complex are used for range, water supply, and wildlife habitat.

Potential vegetation for the Redcan soil is dominantly bluebunch wheatgrass, muttongrass, basin wildrye, Nevada bluegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, birchleaf mountain-

mahogany, mountain snowberry, and yellowbrush. The potential vegetation for the Etchen soil is dominantly bluebunch wheatgrass, Idaho fescue, oniongrass, prairie junegrass, big sagebrush, and some antelope bitterbrush, arrowleaf balsamroot, birchleaf mountainmahogany, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management in areas of excessive shrubs is practical, if reasonable understory of desirable grasses and forbs is present.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, bobcat, weasel, coyote, and badger.

These soils are not presently used for urban or recreational developments because of inaccessibility, steep slopes, depth to bedrock, and high content of rock fragments. Septic tank absorption field problems will develop in places because of depth to bedrock and steep slopes.

Recreational use of these soils is mainly hunting. Capability unit VIIs-M, nonirrigated.

RcG—Redcan-Rock outcrop complex, 40 to 60 percent slopes. This complex of Redcan soil and Rock outcrop occurs on very steep, dominantly south- and west-facing, convex mountainsides at elevations of 6,000 to 6,700 feet. The Redcan cobbly loam, 40 to 60 percent slopes, makes up about 60 percent of the complex, and the Rock outcrop makes up about 15 percent. The Rock outcrop is interspersed throughout on ridges and as ledges and outcroppings of bare bedrock.

Included within this complex in mapping are small areas of Etchen very cobbly loam, 25 to 50 percent slopes, Hoskin cobbly loam, 30 to 50 percent slopes, and Norcan loam, 30 to 60 percent slopes.

The Redcan soil is shallow and well drained. It formed in materials weathered from sandstone and shale. The slopes are short or medium in length. The average annual precipitation is about 18 inches, mean annual air temperature is about 43 degrees F, and the frost-free season is about 80 days.

In a typical profile, the surface layer is dark red cobbly loam about 5 inches thick. The underlying layer is reddish brown or weak red very gravelly clay loam or gravelly loam. Weathered sandstone and shale are at a depth of 19 inches. The depth to the bedrock ranges from 14 to 19 inches. This soil is strongly calcareous and moderately alkaline. The rock fragment content is about 30 percent in the surface layer and about 60 percent in the underlying layer.

Permeability is moderate above the bedrock. Effective rooting depth is 15 to 20 inches. The available water capacity is very low. Surface runoff is medium. Erosion hazard is high.

The Rock outcrop is interspersed throughout the complex. It consists of bare fractured sandstone on very steep mountainsides and canyon walls. It is more than 90 percent barren, but may support sparse amounts of bluebunch wheatgrass, muttongrass, and curlleaf mountainmahogany in pockets and cracks.

This complex is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, basin wildrye, Nevada bluegrass, antelope bitterbrush, big sagebrush, and some arrowleaf balsamroot, birchleaf mountainmahogany, mountain snowberry, and yellowbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if there is a reasonable understory of desirable grasses and forbs.

This complex has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, bobcat, weasel, coyote, and badger.

This complex is not used for urban or recreational developments because of its inaccessibility, steep slopes, depth to bedrock, and high content of rock fragments. Septic tank absorption field problems will develop in places because of shallow depth to bedrock and steep slopes.

Recreational use of these soils is mainly hunting. Capability unit VIIs-M, nonirrigated.

ReA—Redola loam, 0 to 2 percent slopes. This Redola soil is very deep and well drained. It occurs on nearly level and gently sloping flood plains and stream terraces at elevations of 4,900 to 5,100 feet. The slopes are medium or long in length. This soil formed in alluvium from sandstone, quartzite, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the frost-free season is about 105 days.

Included with this soil in mapping are small areas of Eastcan loam, 0 to 3 percent slopes, Sunset loam, very gravelly substratum, Steed loam, 0 to 1 percent slopes, and Steed cobbly loam, 0 to 3 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and silt loam in the lower part and is about 24 inches thick. The underlying layer is dark brown fine sandy loam to a depth of 60 inches or more. This soil is moderately calcareous and mildly alkaline.

Permeability is moderate. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is moderate.

The soil is used mainly for irrigated crops. Alfalfa, hay or pasture, corn for silage, and grain are the principal crops.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to control soil erosion and produce favorable crop yields. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Fertilizer applications should be in agreement with crop needs, soil tests, and latest recommendations of the State experiment station. Border, furrow, corrugation, and sprinkler irrigation methods are suited to this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are well suited to row crops. Border irrigation is suited to alfalfa, small grains, and pasture. Land leveling is needed in some areas to obtain an even distribution of irrigation water. Irrigation applications should be adjusted to the available water capacity and intake rate, and irrigation streams should not cause soil movement in furrows, corrugations and borders. Length of runs should be adjusted so that water reaches the end of field without overirrigating the upper part. These practices will help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is well suited for homesites and other urban and recreational developments. Climatically adapted grasses, shrubs and trees for beautification grow well in this soil. Ground water contamination is a hazard where cesspools are used.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability unit IIc-2, irrigated.

RhC—Richens loam, 3 to 15 percent slopes. This Richens soil is deep and well drained. It occurs mainly on undulating and rolling high mountaintops at elevations of 7,500 to 8,200 feet. The slopes are medium or long in length. This soil formed in glacial till weathered from a conglomerate of sandstone and quartzite. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Herd cobbly clay loam, 3 to 15 percent slopes, Yence very stony loam, 3 to 15 percent slopes, and Ercan loam, 3 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 17 inches thick. The subsurface layer is strong brown cobbly silt loam about 2 inches thick. The subsoil is yellowish red gravelly silty clay in the upper part and yellowish red or red clay in the lower part and is about 37 inches thick. Weathered sandstone is at a depth of 56 inches. The depth to weathered bedrock ranges from 55 to 60 inches or more. This soil is mainly slightly acid, but is neutral in the lower part of the subsoil. Rock fragment content is about 5 percent in the surface layer, 40 percent in the subsurface layer, and 25 percent in the upper part of the subsoil. The lower part of the subsoil lacks rock fragments.

Permeability is slow. Effective rooting depth is 55 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for grazing, woodland, wildlife habitat, and water supply.

Potential vegetation is dominantly quaking aspen with an understory of mountain brome, nodding brome, blue wildrye, bearded wheatgrass, nodding bluegrass, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil is suited for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition will delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox.

Because of inaccessibility, this soil has not been used for urban or recreational developments. The limited ability to support a load and the high shrink-swell potential are soil features that limit use for urban or recreational developments. Septic tank absorption field problems develop in places because of slow permeability.

Recreational use of this soil is mainly hunting. Capability unit VIe-H, nonirrigated.

RvG—Richville gravelly loam, 30 to 60 percent slopes. This Richville soil is moderately deep and well drained. It occurs dominantly on south- and west-facing, convex, short mountain foot slopes at elevations of 5,100 to 6,000 feet. The slopes are short and medium in length. This soil formed in materials weathered mostly from tuffaceous sandstone. The average annual precipitation is about 18 inches, mean annual air temperature is about 45 degrees F, and the frost-free season is about 90 days.

Included with this soil in mapping are small areas of Mondey clay loam, 15 to 30 percent slopes, Causey silt loam, 30 to 60 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, and Manila loam, 25 to 40 percent slopes.

In a typical profile, the surface layer is dark brown gravelly loam about 4 inches thick. The subsoil is brown

gravelly clay loam about 8 inches thick. The substratum is brown loam or clay loam. Weathered tuffaceous sandstone is at a depth of 28 inches. The depth to the weathered tuffaceous sandstone ranges from 28 to 40 inches. The surface layer is moderately calcareous and is moderately alkaline. The subsoil and substratum are moderately or strongly calcareous and moderately alkaline. Rock fragments cover about 50 percent of the soil surface. Rock fragment content is about 20 percent in the surface layer, 30 percent in the subsoil, and 5 percent in the substratum.

Permeability is moderately slow. Effective rooting depth is 28 to 40 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply. Some small areas are used for nonirrigated crops. These areas should be seeded to a permanent cover of grasses.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, longtongue muttongrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the range vegetation has seriously deteriorated and a seed source of desirable grasses and forbs is absent. Range seeding will be difficult because of steep slopes. Grasses suitable for seeding include mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for Hungarian partridge, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Steep slopes and moderate depth to weathered bedrock are soil features that limit the potential of this soil for urban development. Septic tank absorption field problems develop in places because of moderately slow permeability, steep slopes, and moderate depth to the weathered bedrock.

This soil is important for watershed but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

RX—Rock outcrop. Rock outcrop consists of exposures of bare limestone, sandstone, quartzite, conglomerate of sandstone and quartzite, and shale on very steep mountainsides, ridges, or canyon walls. Elevations range from 5,500 to 9,700 feet. Slopes are short in length and range from 60 to 100 percent. The average annual precipitation varies from 18 to 40 inches, mean annual air temperature varies from 38 to 45 degrees F, and the average frost-free season varies from 30 to 100 days.

Included with Rock outcrop in mapping are small areas of Lithic Haploxerolls, 40 to 80 percent slopes, Agassiz stony silt loam, 40 to 70 percent slopes, Foxol very cobbly loam, 40 to 70 percent slopes, Redcan cobbly loam, 40 to 60 percent slopes, and Wallsburg gravelly loam, 40 to 60 percent slopes.

The Rock outcrop is mostly barren, but supports sparse amounts of bluebunch wheatgrass, Gambel oak, birchleaf mountainmahogany, Douglas-fir, and Utah juniper in pockets, fractures, and cracks in the bedrock.

These areas have esthetic value and are used for wildlife habitat. Capability unit VIIIs-Z.

SaD—Scave loam, 15 to 30 percent slopes. This Scave soil is very deep and well drained. It occurs on moderately steep to steep, rolling mountainsides at elevations of 7,500 to 9,000 feet. The slopes are short or medium in length. Many kettles or small glacial lakes are scattered throughout the landscape. This soil formed mostly in glacial till from a conglomerate of sandstone and quartzite. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the frost-free period is about 70 days.

Included with this soil in mapping are small areas of Lucky Star silt loam, 15 to 30 percent slopes, and a very deep, well drained, very cobbly clay soil in which the top of the subsoil is below a depth of 40 inches.

In a typical profile, the surface layer is very dark brown loam about 14 inches thick. The subsurface layer is brown very cobbly fine sandy loam about 19 inches thick. The top part of the subsoil is mixed with the subsurface layer. The subsoil is reddish brown very cobbly clay loam to a depth of 60 inches or more. This soil is medium or strongly acid. Rock fragment content is about 20 percent in the surface layer, 70 percent in the subsurface layer, and 60 percent in the subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately low or moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for grazing, woodland, wildlife habitat, summer homesites, and water supply.

Potential vegetation is dominantly quaking aspen with an understory of mountain brome, nodding brome, blue wildrye, nodding bluegrass, and some bearded wheatgrass, aspen peavine, and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for the production of quaking aspen. It is capable of producing about 2,500 cubic feet or 1,000 board feet (International rule) per acre of

merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition will delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine, and red fox. The streams and lakes in the area are potential habitat for beaver.

This soil is used for summer homesites. Steep slopes and high rock fragment content are features of the soil that limit its use for urban and recreational developments. Septic tank absorption fields develop problems in some places because of slow permeability.

This soil is important for watershed. Adequate plant cover needs to be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and summer homes. Capability unit VIe-HA, nonirrigated.

SaG—Scave loam, 30 to 60 percent slopes. This Scave soil is very deep and well drained. It occurs on very steep, high mountainsides at elevations of 7,800 to 9,200 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 35 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Lucky Star silt loam, 30 to 60 percent slopes, Charcol gravelly fine sandy loam, 30 to 50 percent slopes, Condie gravelly loam, 30 to 60 percent slopes, and Schuster loam, 30 to 60 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and cobbly loam in the lower part and is about 19 inches thick. The subsurface layer is brown very gravelly or very cobbly fine sandy loam about 20 inches thick. The subsoil is reddish brown very cobbly clay to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 5 percent in the upper part of the surface layer and 50 percent in the lower part, and about 60 percent in the subsurface layer and subsoil.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately low or moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, woodland, wildlife habitat, summer homesites, and water supply.

Potential vegetation is dominantly quaking aspen with an understory of mountain brome, nodding brome, blue wildrye, bearded wheatgrass, nodding bluegrass, and some aspen peavine and sweet-anise. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for the production of quaking aspen. It is capable of producing about 3,250 cubic feet or 3,400 board feet (International rule) per acre of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Plant competition can delay natural regeneration but will not prevent the eventual development of a fully stocked, normal stand of trees. Conventional methods used in tree harvest are used with difficulty because of the very steep slope. High lead logging method is more efficient and less damaging to the soil surface.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the summer and fall. It also is potential habitat for ruffed grouse, blue grouse, snowshoe hare, coyote, bobcat, weasel, badger, porcupine and red fox. The streams in the area are potential habitat for beaver.

This soil is presently being planned for summer homesites. Very steep slopes and high rock fragment content are features of this soil that limit its use for urban and recreational developments. Septic tank absorption field problems develop in places because of slow permeability and very steep slopes.

This soil is important for water supply. An adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and summer homes. Capability unit VIIe-H, nonirrigated.

ScG—Schuster loam, 30 to 60 percent slopes. This Schuster soil is deep and well drained. It occurs on all aspects, but dominantly on north- and east-facing, smooth or concave, very steep mountainsides at elevations of 5,800 to 8,200 feet. The slopes are medium and long in length. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 28 inches, mean annual air temperature is about 41 degrees F, and the frost-free season is about 70 days.

In a typical profile, the surface layer is dark brown loam about 18 inches thick. The subsurface layer is brown gravelly fine sandy loam about 11 inches thick. The subsoil is dark red gravelly or very gravelly clay loam to depth of 63 inches or more. Depth to bedrock ranges from 47 to more than 63 inches. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer, 30 percent in the subsurface layer, 45 percent in the upper part of the subsoil, and 75 percent in the lower part.

Permeability is moderately slow. Effective rooting depth is 47 to 63 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, recreational developments, and water supply.

Potential vegetation is dominantly Gambel oak, bluebunch wheatgrass, bearded wheatgrass, bigtooth maple, mountain snowberry, Utah snowberry, serviceberry, and some slender wheatgrass. When changes occur in

the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is practical in areas of severely deteriorated vegetation. Broadcast seeding is suitable for small areas, but aerial seeding is generally used on large areas. Grasses suitable for seeding are mountain brome, smooth brome, Regar brome, and orchardgrass.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during spring, winter, and fall. It also is potential habitat for sharp-tailed grouse, chukar, cottontail rabbit, coyote, bobcat, weasel, porcupine, and badger. The streams in the area are potential habitat for beaver.

Steep slopes, inaccessibility, and high rock fragment content are the soil features that limit use for urban and recreational developments. Septic tank absorption fields develop problems in some areas because of moderately slow permeability and very steep slopes.

These soils are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. Capability unit VIIe-MQ, nonirrigated.

SeD—Sessions cobbly loam, 15 to 25 percent slopes. This Sessions soil is very deep and well drained. It occurs on all aspects, but dominantly on north- and east-facing, moderately steep and steep, smooth or concave high mountainsides. The slopes are long or medium in length. Elevations range from 6,100 to 6,500 feet. This soil formed in materials weathered from a conglomerate of sandstone and quartzite and some gneiss, schist, argillite, and phyllite. The average annual precipitation is about 25 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 70 days.

Included with this soil in mapping are small areas of Toone loam, 40 to 60 percent slopes, Hawkins silty clay, 6 to 15 percent slopes, Hawkins silty clay, 15 to 30 percent slopes, Henefer loam, 6 to 15 percent slopes, Fluvaquentic Haploborolls, 1 to 6 percent slopes, and Fluventic Haploxerolls, 1 to 6 percent slopes.

In a typical profile, the surface layer is very dark brown cobbly loam about 11 inches thick. The subsoil is dark reddish brown or reddish brown cobbly or gravelly clay or cobbly or gravelly clay loam about 37 inches thick. The substratum is dark reddish gray clay loam to a depth of 60 inches or more. This soil is neutral or slightly acid. Rock fragment content is about 30 percent in the surface layer, 25 percent in the subsoil, and 5 percent in the substratum.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bigtooth maple, blue wildrye, Gambel oak, chokecherry, mallow ninebark, and some slender wheatgrass, nodding bluegrass, mountain brome, and aster. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during summer and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, weasel, badger, porcupine, and red fox. Streams in the areas are potential habitat for beaver.

This soil has potential for summer cabin sites. The steep slopes and the moderate inability to support a load are soil features that limit use for urban and recreational developments. Septic tank absorption field problems develop in some places because of slow permeabilty.

These soils are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Streams in the area provide some fishing. Capability unit VIe-H, nonirrigated.

SfG—Smarts loam, 40 to 60 percent slopes. This Smarts soil is very deep and well drained. It occurs on all aspects but dominantly on north- and east-facing, smooth and concave, very steep mountainsides. Elevations are 5,200 to 6,500 feet. The slopes are medium or long in length. This soil formed in materials weathered from argillite, phyllite, schist, and some quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 80 days.

Included with this soil in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, Durfee stony loam, 30 to 70 percent slopes, Yeates Hollow very stony loam, 30 to 70 percent slopes, Fluvaquentic Haploborolls, 1 to 6 percent slopes, and Fluventic Haploxerolls, 1 to 6 percent slopes.

In a typical profile (fig. 10), the surface layer is very dark brown loam in the upper part and very dark grayish brown or dark brown gravelly loam in the lower part and is about 26 inches thick. The subsoil is brown gravelly or very gravelly clay loam to a depth of 72 inches or more. This soil is slightly acid. Rock fragment content is about 15 percent in the upper part of the surface layer and 45 percent in the lower part of the surface layer and about 50 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate or moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, water supply, and wildlife habitat.

Potential vegetation is dominantly bluebunch wheatgrass, bearded wheatgrass, basin wildrye, bigtooth maple, mountain snowberry, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, provided a reasonable understory of desirable grasses and forbs is present.

This soil has potential for supporting plants that provide habitat for mule deer during the spring, fall, and summer. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

Inaccessibility, very steep slopes, and high content of rock fragments are the features of this soil that limit its use for urban or recreational developments. Septic tank absorption field problems develop in some places because of moderate permeability and very steep slopes.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-MN, nonirrigated.

SgG—Smarts loam, moderately deep, 40 to 70 percent slopes. This Smarts soil is deep and well drained. It occurs on all aspects but dominantly on north- and east-facing, smooth and concave, very steep mountainsides at elevations of 5,700 to 8,200 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from quartzite. The average annual precipitation is about 22 inches, mean annual temperature is about 42 degrees F, and the frost-free season is about 75 days.

Included with this soil in mapping are small areas of Durst gravelly loam, 40 to 70 percent slopes, Lucky Star silt loam, 30 to 60 percent slopes, Burgi loam, 40 to 70 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown loam in the upper part and gravelly loam in the lower part and is about 28 inches thick. The subsoil is brown very gravelly clay loam about 13 inches thick. Fractured quartzite bedrock is at a depth of 41 inches. The depth to the bedrock ranges from 40 to 50 inches. This soil is medium acid. Rock fragment content is about 15 percent in the upper part of the surface layer, 35 percent in the lower part of the surface layer, and about 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 40 to 50 inches. The available water capacity is moderately low. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is Gambel oak, bearded wheatgrass, bluebunch wheatgrass, mountain snowberry, bigtooth maple, serviceberry, and some arrowleaf balsamroot and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is advisable in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

The very steep slopes and inaccessibility of this soil are features that limit its potential for urban and recreational developments. Septic tank absorption field problems develop in some areas because of depth to bedrock and very steep slopes.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-MQ, nonirrigated.

SmA—Steed loam, 0 to 1 percent slopes. This Steed soil is very deep and well drained. It occurs on nearly level stream terraces and flood plains at elevations of 5,000 to 5,050 feet. The slopes are medium or long in length. This soil formed in alluvium from quartzite, sandstone, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Redola loam, 0 to 2 percent slopes, Parlo loam, 0 to 3 percent slopes, Steed cobbly loam, 0 to 3 percent slopes, Eastcan loam, 0 to 3 percent slopes, and Sunset loam, very gravelly substratum.

In a typical profile, the surface layer is dark brown loam about 16 inches thick. The upper part of the underlying layer is brown very gravelly very fine sandy loam about 6 inches thick, and the lower part is dark yellowish brown very gravelly coarse sand to a depth of 60 inches or more. This soil is slightly calcareous and moderately alkaline. Rock fragment content is about 5 percent in the surface layer and 60 percent in the underlying layer. Flooding is common during the late winter and spring.

Permeability is moderate in the surface layer and rapid in the underlying layer. Intake rate is very rapid. Effective rooting depth is 60 inches or more. The available water capacity is low or moderately low. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for homesites, urban and recreational developments, and irrigated crops. Hay, pasture, corn for silage, and small grains are the principal crops.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. The furrow and corrugation methods are suited to row crops. Border irrigation is adapted to alfalfa, small grains, and pasture. Land leveling is needed in some places to obtain an even distribution of irrigation water. In leveling, care needs to be taken to prevent making cuts that expose the underlying very gravelly sand. Irrigation applications should be adjusted to the crop needs and the available water capacity. Irrigation stream size should be controlled so that minimal soil movement occurs in furrows, corrugations, and borders. Length of runs should be adjusted so that water reaches the end of field without overirrigating the upper part. These practices help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

Flooding limits the use of this soil for urban developments. However, with stream flow management the flooding hazard is rarely a problem. Septic tank filter fields perform well unless flooded. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Contamination of the ground water supply is a hazard in areas using cesspools or septic tanks.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit IIIs-2, irrigated.

SnA—Steed cobbly loam, 0 to 3 percent slopes. This Steed soil is very deep and well drained. It occurs on nearly level and gently sloping flood plains and stream terraces at elevations of 5,000 to 5,150 feet. The slopes are medium or long in length. This soil formed in alluvium from quartzite, sandstone, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Steed loam, 0 to 1 percent slopes, Eastcan loam, 0 to 3 percent slopes, Redola loam, 0 to 2 percent slopes, Fluvaquentic Haploborolls, 1 to 6 percent slopes, and Fluventic Haploxerolls, 1 to 6 percent slopes.

In a typical profile, the surface layer is very dark grayish brown or dark brown cobbly loam about 8 inches thick. The upper part of the underlying layer is dark brown gravelly loam about 5 inches thick, and the lower part is dark yellowish brown very gravelly sand to a depth of 62 inches or more. The surface layer is moderately calcareous and moderately alkaline. The underlying layer is slightly calcareous and moderately alkaline. Rock fragment content is about 30 percent in the surface layer and the upper part of the underlying layer and about 75 percent in the lower part of the underlying layer. Flooding from nearby streams is common during late winter and spring.

Permeability is moderate in the surface layer and rapid in the underlying layer. Intake rate is very rapid. Effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for homesites and urban and recreational developments. Areas of this soil are mostly idle or abandoned cropland.

Alfalfa and small grains are suitable crops. Surface cobbles create a cultivation problem unless they are removed. Crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues to sustain good crop yields. Generally all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizer. Sprinkler irrgation is well suited to this soil. It provides even distribution and application of irrigation water. Irrigation applications should be adjusted to crop needs, and available water capacity, and infiltration rate to avoid overirrigation and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and to prevent seepage losses and excessive ditch erosion.

The high amount of rock fragments on the soil surface make the use of tillage equipment difficult. Areas with a large amount of rock fragments should be seeded to a forage crop. Plants suitable for seeding on irrigated soil include smooth brome, Regar brome, orchardgrass, and alfalfa. Nonirrigated areas should be seeded to intermediate wheatgrass, crested wheatgrass, and Ladak alfalfa.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat.

This soil is also used for homesites and urban and recreational developments. Flooding limits the use of this soil for these developments. However, with stream flow management flooding is rarely a hazard. Septic tanks perform well unless flooded. Climatically adapted grasses,

shrubs, and trees for beautification will grow on this soil, but additional topsoil is beneficial. Contamination of the ground water supply is a hazard where cesspools are used.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit IVs-2, irrigated.

SoG—St. Marys cobbly loam, 30 to 50 percent slopes. This St. Marys soil is deep and well drained. It occurs dominantly on south- and west-facing, smooth or convex, very steep mountainsides at elevations of 5,500 to 7,800 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 80 days.

Included with this soil in mapping are small areas of Moweba gravelly loam, 30 to 50 percent slopes, and Hoskin cobbly loam, 30 to 50 percent slopes.

In a typical profile, the surface layer is dark reddish brown cobbly or very cobbly loam about 19 inches thick. The subsoil is dark reddish brown, reddish brown, or yellowish red very cobbly loam or very cobbly sandy clay loam about 30 inches thick. The substratum is yellowish red very cobbly sandy loam to a depth of 60 inches or more. Depth to bedrock ranges from 40 to 60 inches or more. This soil is neutral in the surface layer and subsoil. The substratum is slightly acid. Rock fragment content is about 30 percent in the upper part of the surface layer, 50 percent in the lower part of the surface layer, and about 60 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 40 inches or more. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable forbs and grasses is present. Range seeding is advisable if the vegetation has seriously deteriorated. Because of very steep slopes and a cobbly surface layer, aerial or broadcast seeding should be used. Grasses suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide habitat for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine. Streams in the area are potential habitat for beaver.

Inaccessibility, steep slopes and high content of rock fragments are soil features that limit this soil for urban development. In areas close to water supplies, septic tank absorption fields are pollution hazards.

This soil is important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

SrG—St. Marys very stony loam, 40 to 60 percent slopes. This St. Marys soil is deep and well drained. It occurs on south- and west-facing, smooth and convex, very steep mountainsides. Elevations range from 6,500 to 8,900 feet. The slopes are short or medium in length. This soil formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of St. Marys cobbly loam, 30 to 50 percent slopes, Toone loam, 40 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark grayish brown very stony loam in the upper 7 inches and dark brown very cobbly loam in the lower 7 inches. The subsoil is yellowish red very cobbly sandy clay loam about 22 inches thick. The substratum is red very cobbly sandy loam about 8 inches thick. A conglomerate of sandstone and quartzite is at a depth of 44 inches. The depth to the bedrock ranges from 40 to 60 inches or more. This soil is neutral in the upper part of the surface layer and slightly acid in the lower part of the surface layer. The subsoil and substratum are slightly acid or medium acid. Rock fragment content is about 50 percent in the surface layer and about 70 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 40 inches or more. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the range vegetation has seriously deteriorated. Because of very steep slopes and stony surface layer, aerial or broadcast seeding are the most practical methods. Grasses suitable for seeding are mountain brome, smooth brome, Regar brome, slender

wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine. Streams in the area are potential habitat for beaver.

Inaccessibility and high content of rock fragments are features that limit the use of this soil for urban development. Septic tank absorption fields, where close to water supply sources, are a pollution hazard.

This soil is important for watershed, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIs-M, nonirrigated.

SsD—St. Marys-Guilder complex, 3 to 25 percent slopes. This complex of St. Marys and Guilder soils occurs dominantly on alluvial fans and in canyon bottoms at elevations of 6,400 to 6,800 feet. The St. Marys gravelly loam, 8 to 25 percent slopes, makes up about 50 percent of the complex. It occurs on short, convex side slopes and ridges. The Guilder loam, 3 to 15 percent slopes, makes up about 30 percent of the complex. It occurs on short, smooth, and concave side slopes.

Included with this complex in mapping are small areas of Moweba gravelly loam, 6 to 15 percent slopes, Cumulic Haploborolls, wet, and Cumulic Haploxerolls, loamy.

Both of these soils formed in alluvium weathered from sandstone and quartzite. The average annual precipitation is about 18 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 75 days.

The St. Marys soil is deep and well drained. In a typical profile, the surface layer is dark reddish brown gravelly loam in the upper part and very cobbly fine sandy loam in the lower part and is about 19 inches thick. The subsoil is dark reddish brown very gravelly fine sandy loam about 18 inches thick. The substratum is dark red very cobbly or gravelly loamy fine sand to a depth of 60 inches or more. The surface layer is mildly alkaline. The subsoil is moderately calcareous and moderately alkaline. The substratum is strongly calcareous and moderately alkaline. Rock fragment content is about 20 percent in the upper part of the surface layer and 60 percent in the lower part. The subsoil and substratum have about 50 percent rock fragments.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately low. Surface runoff is slow. Erosion hazard is high.

The Guilder soil is deep and well drained. In a typical profile, the surface layer is dark brown loam about 6 inches thick. The subsoil is reddish brown clay loam in the upper part and reddish brown clay loam in the lower part, and is about 21 inches thick. The substratum is reddish brown or yellowish red loam or very gravelly loam to a depth of 60 inches or more. This soil is neutral or slightly acid in the surface layer and in the upper part of the subsoil. It is strongly calcareous and moderately alkaline in the lower part of the subsoil and in the substratum. Rock fragment content is about 50 percent in some parts of the substratum.

Permeability is slow. Effective rooting depth is 60 inches or more. The available water capacity is high. Organic-matter content in the surface layer is moderately high. Surface runoff is medium. Erosion hazard is moderate under the native vegetation but high if vegetation is removed and the soil is left bare.

These soils are used mainly for range, wildlife habitat, and water supply.

Potential vegetation for the St. Marys soil is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. Potential vegetation for the Guilder soil is dominantly bluebunch wheatgrass, basin wildrye, muttongrass, bearded wheatgrass, and some antelope bitterbrush and mountain snowberry. When changes occur in the potential vegetation composition on these soils due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, provided a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the plant composition has severely deteriorated. Successful range seeding depends on seedbed preparation, depth of seeding, and time of seeding. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or intermediate wheatgrass.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, weasel, porcupine, red fox, and badger. Streams in the area are potential habitat for beaver.

The soils in the complex are not used for urban or recreational developments because of inaccessibility. The soil feature of the St. Marys soil that limits its use for urban and recreational developments is the high amount of rock fragments. Septic tank absorption field problems develop in some areas because of moderately slow permeability in the Guilder soil.

This complex is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential. If plant cover has seriously deteriorated or the soil is disturbed, these soils are major sources of sediment production.

Recreational uses of the soils in this complex are mainly hunting and snowmobiling. Capability unit VIs-M, nonirrigated.

StG—St. Marys-Hoskin cobbly loams, 30 to 50 percent slopes. This complex of St. Marys and Hoskin soils occurs dominantly on south- and west-facing, very steep mountainsides at elevations of 5,500 to 7,000 feet. The St. Marys cobbly loam, 30 to 50 percent slopes, occurs on the smooth or concave medium and long side slopes. The Hoskin cobbly loam, 30 to 50 percent slopes, occurs on the short and medium, convex side slopes and ridges. Each of these soils makes up about 40 percent of the complex.

Included with this complex in mapping are small areas of Moweba gravelly loam, 30 to 50 percent slopes, Henefer loam, 40 to 60 percent slopes, and some Rock outcrop.

Both the St. Marys and Hoskin soils in this complex formed in materials weathered mostly from a conglomerate of quartzite and sandstone. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 75 days.

The St. Marys soil is deep and well drained. In a typical profile, the surface layer is dark reddish brown or dark brown cobbly loam about 10 inches thick. The subsoil is reddish brown very cobbly loam or very cobbly sandy clay loam about 30 inches thick. The substratum is reddish brown very cobbly sandy loam to a depth of 60 inches or more. Depth to the bedrock ranges from 52 to 60 inches or more. This soil is neutral in the surface layer and neutral or slightly acid in the subsoil and substratum. Rock fragment content is about 30 percent in the surface layer and 60 percent in the subsoil and substratum.

Permeability is moderate. Effective rooting depth is 52 to 60 inches or more. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

The Hoskin soil is moderately deep and well drained. In a typical profile, the surface layer is dark reddish brown cobbly loam about 14 inches thick. The subsoil is dark reddish brown or dark red very cobbly sandy clay loam about 14 inches thick. Weathered conglomerate of sandstone and quartzite is at a depth of 28 inches. The depth to the bedrock ranges from 22 to 29 inches. This soil is neutral in the surface layer and neutral or slightly acid in the subsoil. Rock fragment content is about 45 percent in the surface layer and 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 22 to 29 inches. The available water capacity is moderately low. Surface runoff is medium. Erosion hazard is high.

These soils are used mainly for range, wildlife habitat, and water supply.

Potential vegetation for the St. Marys soil is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. Potential vegetation for the Hoskin soil is dominantly bluebunch wheatgrass, oniongrass, Idaho fescue, prairie junegrass, antelope bitterbrush, big sagebrush, and some mountain snowberry, arrowleaf balsamroot, and yellowbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable forbs and grasses is present.

The soils in this complex have potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams in the area are potential habitat for beaver.

Soils in this complex are not used for homesites because of inaccessibility and very steep slopes. Where septic tank absorption fields are near water supply sources, pollution is a hazard.

These soils are important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

SuD—Stoda loam, 10 to 25 percent slopes. This Stoda soil is very deep and well drained. It occurs on moderately steep and steep lake terraces. Elevations are 4,850 to 5,200 feet. The slopes are short in length. This soil formed in lake sediments. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Stoda loam, 40 to 60 percent slopes, Parleys loam, high rainfall, 0 to 3 percent slopes, and Mondey clay loam, 8 to 15 percent slopes.

In a typical profile, the surface layer is very dark brown or very dark grayish brown loam about 11 inches thick. The subsoil is dark brown loam about 8 inches thick. The substratum is brown loam about 26 inches thick. Below a depth of 45 inches it is stratified brown very fine sandy loam and silty clay loam to a depth of 67 inches or more. The surface layer is slightly calcareous and mildly alkaline. The subsoil is moderately calcareous and moderately alkaline. The substratum is strongly calcareous and strongly alkaline.

Permeability is moderate. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for nonirrigated crops. Mostly small grains are grown in a continuous cropping system.

This soil is well suited to winter wheat and produces higher yields of this crop than of spring varieties. Some areas are planted to Ladak alfalfa and pubescent and intermediate wheatgrass for hay or pasture. Fertilizers should be applied in agreement with plant needs, soil tests, and State experiment recommendations. Erosion can be reduced if fall grain is seeded early and stubble-

mulch tillage is used. Terraces, diversions, and grassed waterways should be installed where needed. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be on the contour or across the slope. These practices slow the rate of runoff and reduce erosion during periods of rapid snowmelt and high intensity rainfall.

This soil has potential for supporting plants that provide food for mule deer, primarily during the fall, winter, and spring. It also is potential habitat for chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, coyote, weasel, and badger.

The moderately steep and steep slopes are features that limit use for urban and recreational developments. Septic tank absorption field problems develop in some areas because of the moderately steep and steep slopes.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit is IVe-M, nonirrigated.

SuG—Stoda loam, 40 to 60 percent slopes. This Stoda soil is very deep and well drained. It occurs on very steep, high lake terrace escarpments at elevations of 4,850 to 5,150 feet. The slopes are short in length. This soil formed in lake sediments weathered mostly from tuffaceous sandstone and quartzite. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Stoda loam, 10 to 25 percent slopes, Mondey clay loam, 8 to 15 percent slopes, Mondey clay loam, 15 to 30 percent slopes, and Richville gravelly loam, 30 to 60 percent slopes.

In a typical profile, the surface layer is very dark grayish brown or dark brown loam about 11 inches thick. The subsoil is dark brown loam about 8 inches thick. The substratum is brown or light brown loam, silt loam, or very fine sandy loam to a depth of 67 inches or more. The surface layer is slightly or moderately calcareous and mildly or moderately alkaline. The subsoil and substratum are strongly calcareous and strongly alkaline.

Permeability is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is bluebunch wheatgrass, basin wildrye, bearded wheatgrass, muttongrass, and some arrowleaf balsamroot, big bluegrass, antelope bitterbrush, mountain snowberry, and big sagebrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. In areas where the vegetation is destroyed or severely deteriorated, aerial or broadcast seeding is advisable. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger.

The very steep slopes of this soil affect its use for urban and recreational developments. Septic tank absorption field problems will develop in some areas because of very steep slopes.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIIe-M, nonirrigated.

SwA—Sunset loam, very gravelly substratum. This Sunset soil is very deep and somewhat poorly drained. It occurs on nearly level flood plains and stream terraces at elevations of 4,800 to 5,150 feet. Slope is 0 to 1 percent. Slopes are long. This soil formed in alluvium from sandstone, quartzite, and limestone. The average annual precipitation is about 18 inches, mean annual air temperature is about 46 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Pringle loam, Eastcan loam, 0 to 3 percent slopes, Canburn silt loam, Redola loam, 0 to 2 percent slopes, Utaba cobbly loam, warm, and Utaba loam, warm.

In a typical profile, the surface layer is very dark grayish brown loam about 17 inches thick. The upper part of the underlying layer is dark brown or dark yellowish brown stratified loam, silt loam, or very fine sandy loam about 28 inches thick. The lower part of the underlying layer is dark brown very gravelly sand to a depth of 63 inches or more. This soil is moderately alkaline and moderately calcareous in the surface layer and the upper part of the underlying layer. The lower part of the underlying layer is slightly calcareous and moderately alkaline. Rock fragment content is about 65 percent below a depth of about 45 inches. Mottles commonly occur at a depth of about 20 inches. The depth to seasonal high water table ranges from 30 to 36 inches. Occasional flooding occurs during the late winter and early spring during periods of rapid snowmelt.

Permeability is moderate to a depth of 45 inches and is moderately rapid below this depth. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderate or moderately high. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated hay, pasture, corn for silage, and small grains.

A suitable crop rotation is 4 to 6 years of alfalfa, 2 years of corn, 1 year of small grains, and 1 year of small grains with alfalfa planted in the stubble. Because of the seasonal high water table, stands of alfalfa are difficult to

maintain. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth and infiltration rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizer. Border, furrow, corrugation, and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops. It provides even distribution and efficiency in the application of irrigation water. The furrow and corrugation methods are well suited to row crops. Border irrigation is well suited to alfalfa, small grains, and pasture. Land leveling is required in some areas to obtain an even distribution of irrigation water. Irrigation applications should be adjusted to the crop needs, available water capacity, and infiltration rate. Irrigation streams should not cause soil movement in furrows, corrugations, or borders. Length of runs should be adjusted so that water reaches the end of field without overirrigating the upper part. These practices will help control soil erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has good potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners will improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is rapidly being used for home sites and other urban developments. The depth to the seasonal high water table and the hazard of flooding are features that limit use for urban or recreational developments. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption field problems develop in some areas because of flooding. Cesspool seepage is a pollution hazard to ground waters.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit IIw-2, irrigated.

TaG—Toncana loam, 40 to 60 percent slopes. This Toncana soil is very deep and well drained. It occurs dominantly on north- and east-facing, smooth and concave, very steep mountainsides at elevations of 6,100 to 6,800 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 43 degrees F, and the average frost-free season is about 75 days.

Included with this soil in mapping are small areas of Norcan loam, 30 to 60 percent slopes, Schuster loam, 30 to 60 percent slopes, Henhoit gravelly loam, 30 to 60 percent slopes, St. Marys very stony loam, 40 to 60 percent slopes, and some Rock outcrop.

In a typical profile, the surface layer is very dark brown or dark reddish brown loam about 24 inches thick. The subsoil is dark reddish brown or dark red gravelly or very gravelly clay loam to a depth of 60 inches or more. This soil is medium acid. Rock fragment content is about 15 percent in the surface layer and 50 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used for range, wildlife habitat, and water supply.

Potential vegetation is Gambel oak, bearded wheatgrass, bluebunch wheatgrass, mountain brome, Nevada bluegrass, slender wheatgrass, birchleaf mountain-mahogany, and some arrowleaf balsamroot and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the spring, summer, and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, porcupine, red fox, coyote, bobcat, weasel, and badger. Streams that run through the area are potential habitat for beaver.

The very steep slopes and relative inaccessibility of this soil are features that limit its potential use for urban and recreational developments. Septic tank absorption field problems develop in some areas because of moderately slow permeability and very steep slopes.

This soil is important for water supply. Adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed.

Recreational use of this soil is mainly hunting. Capability unit VIIe-MQ, nonirrigated.

TeG—Toone loam, 40 to 60 percent slopes. This Toone soil is very deep and well drained. It occurs dominantly on east-facing, very steep mountainsides at elevations of 5,800 to 6,700 feet. The slopes are medium and long in length. This soil formed in materials weathered from a conglomerate of sandstone and quartzite and some gneiss and schist. The average annual precipitation is about 30 inches, mean annual air temperature is about 42 degrees F, and the frost-free season is about 65 days.

Included with this soil in mapping are small areas of Poleline stony loam, 40 to 70 percent slopes, St. Marys very stony loam, 40 to 60 percent slopes, and Sessions cobbly loam, 15 to 25 percent slopes.

In a typical profile, the surface layer is very dark brown loam about 27 inches thick. The subsoil is dusky red very cobbly clay loam or gravelly clay loam to a

depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer and 50 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bigtooth maple, blue wildrye, Gambel oak, mallow ninebark, chokecherry and some bearded wheatgrass, mountain brome, nodding bluegrass, sweet-anise, and elderberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during summer and fall. It also is potential habitat for sharp-tailed grouse, cottontail rabbit, red fox, porcupine, coyote, bobcat, weasel, and badger. Streams in the area are potential habitat for beaver.

Because of inaccessibility and very steep slopes, this soil is not used for urban or recreational developments. Septic tank absorption field problems will develop in some areas because of moderately slow permeability and very steep slopes.

Recreational use of this soil is mainly hunting. Capability unit VIIe-H, nonirrigated.

TnA—Trojan loam, warm, 0 to 3 percent slopes. This Trojan soil is very deep and well drained. It occurs on nearly level, gently sloping, and undulating stream terraces and alluvial fans at elevations of 5,100 to 5,400 feet. The slopes are short or medium in length. This soil formed in materials weathered from argillite, phyllite, schist, and some quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Brownlee loam, 0 to 3 percent slopes, Kahler gravelly loam, 3 to 6 percent slopes, Kahler gravelly loam, 6 to 10 percent slopes, and a soil similar to Trojan that has more than 35 percent rock fragments in the subsoil.

In a typical profile, the surface layer is dark brown loam about 11 inches thick. The subsoil is dark yellowish brown or brown gravelly clay loam about 39 inches thick. The substratum is dark brown very cobbly clay loam to a depth of 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the surface layer, 30 percent in the subsoil, and 60 percent in the substratum.

Permeability is moderate. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderate or moderately high. Surface runoff is slow. Erosion hazard is moderate.

The soil is used mainly for irrigated crops. Alfalfa, hay or pasture, and small grains are the principal crops.

A suitable crop rotation is 6 to 8 years of alfalfa and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth and infiltration rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Border and sprinkler irrigation methods are suitable for this soil. The method used is generally governed by the crop. Sprinkler irrigation is well suited to most crops and provides even distribution and efficient application of irrigation water. Border irrigation is well suited to alfalfa, small grains, and pasture. Land leveling is required in some areas to obtain an even distribution of irrigation water. Irrigation applications should be adjusted to crop needs, available water capacity, and infiltration rate. Irrigation streams should not cause soil movement in borders. Length of runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. These practices will help control erosion and excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that protects the birds from predators and inclement weather.

This soil is suited for homesites and other urban and recreational developments. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption field problems develop on some areas because of the moderate permeability. Contamination of the ground water supply is a hazard where cesspools are used.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability unit IIIc-3, irrigated.

TnD—Trojan loam, warm, 8 to 15 percent slopes. This Trojan soil is very deep and well drained. It occurs on strongly sloping and moderately steep stream terraces and alluvial fans at elevations of 5,100 to 5,700 feet. The slopes are short or medium in length. This soil formed in materials weathered from phyllite, argillite, schist, and some quartzite. The average annual precipitation is about 21 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 95 days.

Included with this soil in mapping are small areas of Trojan loam, warm, 0 to 3 percent slopes, Brownlee loam, 0 to 3 percent slopes, and Brownlee loam, 3 to 6 percent slopes.

In a typical profile, the surface layer is very dark grayish brown or dark brown loam about 16 inches thick. The subsoil is dark brown or brown gravelly clay loam about 32 inches thick. The substratum is dark brown cobbly clay loam to a depth of 60 inches or more. This soil is slightly acid in the surface layer and medium acid in the subsoil and substratum. Rock fragment content is about 15 percent in the surface layer, 20 percent in the subsoil, and 35 percent in the substratum.

Permeability is moderate. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is moderate or moderately high. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for nonirrigated and irrigated crops. Some small areas are used as range. Alfalfa and small grains are the principal crops.

When irrigated, a suitable crop rotation is 6 to 8 years of alfalfa, and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth and infiltration rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer and legumes respond readily to phosphate fertilizer. Sprinkler irrigation is well suited to this soil because of slope. It provides an even distribution and efficient application of irrigation water. Irrigation applications should be adjusted to crop needs and available water capacity and infiltration rate. Careful irrigation applications will avoid overirrigation and leaching of plant nutrients.

When this soil is used for nonirrigated crops, small grains are grown in a continuous cropping system. Soil erosion is a problem on the steep slopes. This soil should be in permanent cover 75 percent of the time. Ladak alfalfa and intermediate wheatgrass are suitable for hay and pasture seedings. Winter wheat and barley are the principal small grain crops. Nitrogen should be applied to meet plant needs for maximum production of small grain and grasses. Alfalfa responds to phosphate fertilizers. Latest State experiment station recommendations for fertilizer should be followed. Erosion control practices on this soil include seeding early in the fall and stubble-mulch tillage. Terraces, diversions, and grassed waterways should also be installed where needed to help reduce soil erosion. Drop structures are needed in a few places to stabilize the flow of runoff in waterways. All tillage practices should be either on the contour or across the slope to slow the rate of runoff and reduce soil losses in years of rapid snowmelt or high rainfall intensity.

This soil has potential for supporting plants that provide food and cover for mule deer, primarily during the winter and spring. It also is potential habitat for Hungarian partridge, mourning dove, chukar, cottontail and jackrabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is well suited for homesites and other urban and recreational developments. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil. Septic tank absorption field problems develop in some areas because of moderate permeability. Contamination of the ground water supply is a hazard where cesspools are installed.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability units IVe-3, irrigated, and IVe-M, nonirrigated.

UaA—Utaba cobbly loam. This Utaba soil is very deep and well drained. It occurs on nearly level and gently sloping alluvial fans, flood plains, and stream terraces at elevations of 5,300 to 5,650 feet. Slopes are 0 to 3 percent. The slopes are short or medium in length. This soil formed in alluvium from sandstone and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 90 days.

Included with this soil in mapping are small areas of Utaba soil that lack the surface cobbles; Eastcan loam, cool, 0 to 3 percent slopes; Eastcan variant loam, cool, 6 to 10 percent slopes; and Isbell loam, gravelly substratum, 6 to 15 percent slopes.

In a typical profile, the surface layer is dark brown cobbly loam in the upper part and gravelly sandy loam in the lower part and is about 29 inches thick. The underlying layer is yellowish red very gravelly sand to a depth of 60 inches or more. The surface layer is slightly acid and the underlying layer is medium acid. Rock fragment content is about 20 percent cobbles on the soil surface, 40 percent in the surface layer, and 70 percent in the underlying layer. Flooding from nearby streams is rare to common during late winter or spring.

Permeability is moderate in the surface layer and rapid in the underlying layer. Intake rate is very rapid. Effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow. Erosion hazard is moderate.

This soil is mainly idle or is abandoned cropland. Many areas have been cleared of the surface cobbles for tillage.

Where cobbles have been removed, alfalfa and small grains or improved pasture are suitable crops. Crop residue use, weed control, and minimum tillage are recommended to help reduce erosion and maintain favorable tilth. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizers. Sprinkler irrigation is well suited to this soil. It provides even distribution and application of irrigation water. Irrigation applications should be adjusted to crop needs, and the available water capacity and infiltration rate. Overirrigation should be avoided because it causes excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate

irrigation and to reduce seepage losses and excessive ditch erosion. Rock fragments on the soil surface makes normal operation of tillage equipment very difficult. Seeding of these areas to grasses, alfalfa, or both is desirable and improves plant cover, increases forage production, and helps reduce soil erosion. Plants suitable for seeding on irrigated areas include smooth brome, Regar brome, orchardgrass, and alfalfa. The nonirrigated areas are suitable for intermediate wheatgrass, crested wheatgrass, and Ladak alfalfa.

This soil has potential for supporting plants that provide food and cover for mule deer during winter and spring. It also is potential habitat for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail and jackrabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

Flooding is a problem that limits the use of this soil for urban or recreational developments. However, with present water regulation reservoirs flooding is rare. Septic tank filter fields perform well unless flooded. Climatically adapted grasses, shrubs, and trees for beautification grow, but addition of topsoil improves their available water capacity. Contamination of the ground water supply is a hazard where cesspools are installed.

Recreational uses are mainly hunting and snowmobiling. Capability unit IVs-3, irrigated.

UbA—Utaba cobbly loam, warm. This Utaba soil is very deep and well drained. It occurs on nearly level and gently sloping flood plains and stream terraces at elevations of 4,850 to 5,000 feet. The slopes are long. This soil formed in alluvium mostly from quartzite and sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Utaba loam, warm, Eastcan loam, 0 to 3 percent slopes, Sunset loam, very gravelly substratum, Fluvaquentic Haploborolls, 1 to 6 percent slopes, and Fluventic Haploxerolls, 1 to 6 percent slopes.

In a typical profile, the surface layer is very dark brown or dark brown cobbly loam in the upper part and very gravelly sandy clay loam in the lower part and is about 21 inches thick. The underlying layer is dark reddish brown or reddish brown very gravelly loamy sand, very gravelly coarse sand, or very cobbly coarse sand to a depth of 60 inches or more. This soil is slightly acid or medium acid. The soil surface has about 10 percent cover of cobbles and 20 percent gravel. Rock fragments content is about 35 percent in the upper part of the surface layer, and 60 percent in the lower part, and 75 percent in the underlying layer. Flooding from nearby streams commonly occurs during the late winter and spring.

Permeability is moderate in the surface layer and rapid in the underlying layers. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow. Erosion hazard is moderate.

Most areas of this soil are abandoned or idle cropland. Many areas have been cleared of the surface cobbles.

Alfalfa and small grains, or improved pasture are suitable when the surface cobbles have been removed. Crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizers, and legumes respond readily to phosphate fertilizers. Sprinkler irrigation is suited to this soil. This method provides for even distribution and controlled application of irrigation water. Irrigation applications should be in agreement with crop needs and the available water capacity and infiltration rate. Overirrigation should be avoided because it causes excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and to reduce seepage losses and excessive ditch erosion. Rock fragments on the soil surface make the normal operation of tillage equipment difficult. Seeding of these areas to grasses, alfalfa, or both is desirable and improves plant cover and helps reduce soil erosion. Plants suitable for seeding on irrigated areas include smooth brome, Regar brome, orchardgrass, and alfalfa. The nonirrigated areas are suitable for intermediate wheatgrass, crested wheatgrass, and Ladak alfalfa.

This soil has potential for supporting plants that provide food and cover for mule deer during winter and spring. It also is potential habitat for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail and jackrabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

Flooding limits the use of this soil for urban or recreational developments. However, with present water regulatory reservoir, flooding is rare. Septic tanks perform well unless flooded. Climatically adapted grasses, shrubs, and trees for beautification grow well on this soil but additional topsoil improves available water capacity. Contamination of the ground water is a hazard where cesspools are installed.

Recreational uses are mainly hunting and snowmobiling. Capability unit IVs-2, irrigated.

UcA—Utaba loam, warm. This Utaba soil is very deep and well drained. It occurs on nearly level or gently sloping alluvial fans, flood plains, and stream terraces at elevations of 5,300 to 5,650 feet. The slopes are long. This soil formed in alluvium from quartzite and sandstone. The average annual precipitation is about 20 inches, mean annual air temperature is about 45 degrees F, and the average frost-free season is about 105 days.

Included with this soil in mapping are small areas of Utaba cobbly loam, warm, Eastcan loam, 0 to 3 percent slopes, Sunset loam, very gravelly substratum, Fluvaquentic Haploborolls, 1 to 6 percent slopes, and Fluventic Haploxerolls, 1 to 6 percent slopes.

In a typical profile, the surface layer is very dark brown or dark brown loam in the upper part and very gravelly sandy clay loam in the lower part and is about 13 inches thick. The underlying layer is dark reddish brown or reddish brown very gravelly loamy sand very gravelly or very cobbly coarse sand to a depth of 60 inches or more. This soil is slightly acid or medium acid. The surface loam is about 10 to 20 inches thick. Rock fragment content is about 10 percent in the upper part of the surface layer, 50 percent in the lower part, and 75 percent in the underlying layer. Flooding from nearby streams is rare to common and occur during late winter and spring.

Permeability is moderate in the surface layer and rapid in the underlying layer. Intake rate is rapid. Effective rooting depth is 60 inches or more. The available water capacity is low. Surface runoff is slow. Erosion hazard is moderate.

This soil is used mainly for irrigated crops. Some areas are idle or abandoned cropland. Alfalfa, small grains or improved pasture are the principal crops.

Crop residue use, weed control, and minimum tillage are practices that help to control erosion and maintain favorable tilth. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizers and legumes respond readily to phosphate fertilizers. Sprinkler irrigation is suited to this soil. This method provides for even distribution and application of irrigation water. Irrigation applications should be adjusted to the crop needs and available water supply and infiltration rate. Overirrigation should be avoided because it causes excessive leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent seepage losses and excessive ditch erosion.

This soil has potential for supporting plants that provide food and cover for Hungarian partridge, mourning dove, chukar, ring-necked pheasant, cottontail and jackrabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

Flooding limits the use of this soil for urban or recreational developments. However, with present water regulatory reservoirs, flooding is rare. Septic tank filter fields perform well unless flooded. Climatically adapted grasses, shrubs, and trees for beautification grow well on this soil, but the addition of topsoil improves available water capacity. Contamination of the ground water supply is a hazard where cesspools are installed.

Recreational uses are mainly hunting and snowmobiling. Capability unit IVs-2, irrigated.

YaA—Yeates Hollow loam, 2 to 5 percent slopes. This Yeates Hollow soil is deep and well drained. It occurs on gently sloping and sloping stream terraces, alluvial fans, and high lake terraces at elevations of 5,100 to 5,350 feet. The slopes are medium or long in length. This soil formed in materials weathered from sandstone and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the frost-free season is about 95 days.

Included with this soil in mapping are small areas of Yeates Hollow cobbly loam, 6 to 10 percent slopes, Manila loam, 0 to 3 percent slopes, and Hawkins silty clay, 3 to 6 percent slopes.

In a typical profile, the surface layer is very dark brown loam in the upper part and gravelly loam in the lower part and is about 14 inches thick. The subsoil is dark brown or reddish brown gravelly clay, very cobbly clay, or very gravelly sandy clay to a depth of 45 to 60 inches or more. This soil is slightly acid. Rock fragment content is about 10 percent in the upper part of the surface layer, 25 percent in the lower part, and 60 percent in the subsoil.

Permeability is slow. Intake rate is moderate. Effective rooting depth is 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is moderate.

This soil is used mainly for irrigated crops.

A suitable crop rotation is 6 to 8 years of alfalfa and 2 to 3 years of small grains. Fall plowing, crop residue use, weed control, and minimum tillage are practices that help to reduce erosion and maintain tilth and infiltration rate. Applications of commercial fertilizers are commonly needed in addition to manure and plant residues. Generally all crops respond to nitrogen fertilizer, and legumes respond readily to phosphate fertilizer.

Border, corrugation, and sprinkler irrigation methods are suitable for this soil. Sprinkler irrigation is well suited to most crops. The corrugation and border methods are well suited to alfalfa, small grains, and pasture. Regardless of the method used, irrigation applications should be adjusted to the crop needs and available water capacity and infiltration rate. Irrigation streams should not cause soil movement in corrugations and borders. Length of irrigation runs should be adjusted so that water reaches the end of the field without overirrigating the upper part. This will help control soil erosion and leaching of plant nutrients. Pipe, ditch lining, or irrigation drops should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

This soil has potential for supporting plants that can provide food and cover for Hungarian partridge, mourning dove, chukar, cottontail rabbit, and porcupine. Plants such as Russian-olive, multiflora rose, squawbush, tall wheatgrass, and basin wildrye planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that will protect the birds from predators and inclement weather.

This soil is suited for homesites and other urban or recreational developments. The rock fragment content and the high amount of clay in the subsoil are the main features that limit the use of this soil. Septic tank absorption field problems develop in some areas because of slow permeability. Contamination of the ground water supply is a hazard where cesspools are installed. Climatically adapted grasses, shrubs, and trees for beautification grow well in this soil.

Recreational uses of this soil are mainly snowmobiling and hunting. Capability unit IIIe-3, irrigated.

YbC—Yeates Hollow cobbly loam, 6 to 10 percent slopes. This Yeates Hollow soil is deep and well drained. It occurs on strongly sloping stream terraces and mountain foot slopes at elevations of 5,200 to 6,400 feet. The slopes are medium or long in length. This soil formed in materials weathered from sandstone and quartzite. The average annual precipitation is about 22 inches, mean annual air temperature is about 44 degrees F, and the average frost-free season is about 80 days.

Included with this soil in mapping are small areas of Yeates Hollow loam, 2 to 5 percent slopes, Manila loam, 6 to 10 percent slopes, and Ant Flat loam, 6 to 15 percent slopes.

In a typical profile, the surface layer is very dark grayish brown cobbly loam in the upper part and cobbly silt loam in the lower part and is about 12 inches thick. The subsoil is dark brown cobbly silty clay loam or reddish brown gravelly silty clay or very cobbly clay. Fractured bedrock is at a depth of 43 inches. The depth to the bedrock ranges from 43 to more than 60 inches. This soil is slightly acid. The rock fragment content is about 25 percent in the surface layer, 40 percent in the upper part of the subsoil, and 70 percent in the lower part.

Permeability is slow. Effective rooting depth is 40 inches or more. The available water capacity is moderate. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply. Some small areas are used for nonirrigated crops.

Potential vegetation is dominantly bluebunch wheatgrass, birchleaf mountainmahogany, Nevada bluegrass, muttongrass, longtongue muttongrass, and some oniongrass, Idaho fescue, prairie junegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, some species increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable forbs and grasses is present. Some areas have been cleared of cobbles on the surface. These areas are used mainly for growing alfalfa and small grains. Most previously cropped areas are now planted to intermediate wheatgrass. Other grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, and Garrison meadow foxtail. Where the rock fragment content on the surface will allow, machinery should be used for preparing the seedbed and drilling; otherwise, the broadcast method of seeding can be used.

This soil has potential for supporting plants that provide food and cover for mule deer during the fall, winter, and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams in the area are potential habitat for beaver.

This soil has potential for urban and recreational developments. Some areas of this soil are used for homesites and condominiums. The high rock fragment content and the high amount of clay in the subsoil are soil features that limit use for these purposes. Septic tank absorption field problems develop in some areas because of slow permeability.

Recreational uses of this soil are mainly hunting and snowmobiling. Some areas are used for campsites, paths, and trails. Capability unit VIs-M, nonirrigated.

YcD—Yeates Hollow very stony loam, 10 to 30 percent slopes. This Yeates Hollow soil is deep and well drained. It occurs on moderately steep and steep, rolling mountainsides, benches, and alluvial fans. Elevations range from 5,150 to 6,500 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from a conglomerate of sandstone and quartzite. The average annual precipitation is about 20 inches, mean annual air temperature is about 44 degrees F, and the average frost-free period is about 85 days.

Included with this soil in mapping are small areas of Henefer loam, 6 to 15 percent slopes, Manila loam, 10 to 25 percent slopes, Ant Flat loam, 6 to 15 percent slopes, Holmes very stony loam, high rainfall, 3 to 10 percent slopes, Lamondi stony loam, 3 to 15 percent slopes, and Yeates Hollow cobbly loam, 6 to 10 percent slopes.

In a typical profile, the surface layer is dark brown very stony loam in the upper part and very gravelly loam in the lower part and is about 19 inches thick. The subsoil is dark brown or reddish brown very gravelly clay loam in the upper part and yellowish red or red gravelly sandy clay loam or clay loam in the lower part and is about 36 inches thick. Bedrock occurs at a depth of 55 inches. Depth to bedrock ranges from 55 to 60 inches or more. This soil is slightly acid. Rock fragment content is about 60 percent in the surface layer and in the upper part of the subsoil, and about 30 percent in the lower subsoil.

Permeability is slow. Effective rooting depth is 55 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

This soil is used mainly for range, wildlife habitat, and water supply.

Potential vegetation is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some arrowleaf balsamroot, antelope bitterbrush, and Gambel oak. When changes occur in the potential vegetation composition due to use by livestock

or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. Range seeding is advisable if the range vegetation has seriously deteriorated. Because of steep slopes and very stony surface soil, seeding should be done by aerial methods. Grasses suitable for seeding are mountain brome, smooth brome, Regar brome, slender wheatgrass, orchardgrass, Garrison meadow foxtail, or intermediate wheatgrass.

This soil has potential for supporting plants that provide food and cover for mule deer and elk, primarily during the winter and spring. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, mourning dove, coyote, bobcat, weasel, badger, jackrabbit, and porcupine.

Steep and moderately steep slopes and the rock fragments are features that limit the use of this soil for urban developments. Septic tank absorption field problems develop in some areas because of slow permeability.

This soil is important for watershed, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. An area in Weber County has been developed into a golf course and recreational complex. Capability unit VIs-M, nonirrigated.

YdG—Yeates Hollow-Smarts complex, 30 to 70 percent slopes. This complex of Yeates Hollow and Smarts soils occurs dominantly on very steep east-, south-, and west-facing mountainsides at elevations of 5,200 to 7,400 feet. The Yeates Hollow very stony loam, 30 to 70 percent slopes, makes up about 55 percent of the complex. It occurs on smooth and convex, short and medium side slopes and ridges under a cover of grasses, forbs, and sagebrush. The Smarts loam, 40 to 60 percent slopes, makes up about 35 percent. It occurs on the smooth and concave, medium and long side slopes under a cover of Gambel oak and bigtooth maple.

Included with this complex in mapping are small areas of Yeates Hollow very stony loam, 10 to 30 percent slopes, Foxol very cobbly loam, 40 to 70 percent slopes, and some Rock outcrop.

The Yeates Hollow soil formed in materials weathered from a conglomerate of sandstone and quartzite and some schist, phyllite, and argillite. The Smarts soil formed in materials weathered from schist, phyllite, argillite, and some quartzite and sandstone. Both soils have an average annual precipitation of about 22 inches, mean annual air temperature of about 44 degrees F, and the average frost-free season is about 75 days.

The Yeates Hollow soil is deep and well drained. In a typical profile, the surface layer is very dark brown or dark brown very stony loam or cobbly loam about 13 inches thick. The subsoil is brown or yellowish red cobbly or very cobbly clay loam about 29 inches thick. Bedrock is at a depth of 42 inches. The depth to bedrock ranges from 40 to 42 inches. This soil is slightly acid. The soil surface has 10 to 25 percent cover of rock fragments. Rock fragment content is about 35 percent in the surface layer and in the upper part of the subsoil. The lower part of the subsoil contains about 75 percent rock fragments.

Permeability is slow. Effective rooting depth is 40 to 42 inches. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

The Smarts soils is deep and well drained. In a typical profile, the surface layer is dark brown loam in the upper part and cobbly silt loam in the lower part and is about 20 inches thick. The subsoil is dark brown cobbly or very cobbly clay loam about 24 inches thick. Fractured schist is at a depth of 44 inches. The depth to the bedrock ranges from 40 to 60 inches or more. This soil is slightly acid. Rock fragment content is about 15 percent in the upper part of the surface layer and 40 percent in the lower part and is about 60 percent in the subsoil.

Permeability is moderate. Effective rooting depth is 40 to 60 inches or more. The available water capacity is moderate. Surface runoff is medium. Erosion hazard is high.

The soils in this complex are used mainly for range, wildlife habitat, and water supply.

Potential vegetation for the Yeates Hollow soil is dominantly bluebunch wheatgrass, muttongrass, Nevada bluegrass, birchleaf mountainmahogany, and some oniongrass, Idaho fescue, prairie junegrass, arrowleaf balsamroot, antelope bitterbrush, and mountain snowberry. The potential vegetation for the Smarts soil is dominantly bluebunch wheatgrass, bearded wheatgrass, basin wildrye, muttongrass, slender wheatgrass, bigtooth maple, Gambel oak, and mountain snowberry. When changes occur in the potential vegetation on these soils due to use by livestock wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. When the range vegetation has seriously deteriorated, aerial or broadcast seeding is desirable. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail.

These soils have potential for supporting plants that provide food and cover for mule deer, primarily during the fall, winter, and spring. They also are potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail and jackrabbit, coyote, bobcat, porcupine, red fox, weasel, and badger. Streams in the area are potential habitat for beaver.

These soils are not presently used for urban or recreational developments because of their inaccessibility and very steep slopes. Septic tank absorption field problems will develop on some areas of the Yeates Hollow soil

because of slow permeability and on both soils because of very steep slopes.

Recreational use of these soils is mainly hunting. Capability unit VIIs-M, nonirrigated.

YeD—Yeljack loam, 6 to 15 percent slopes. This Yeljack soil is deep and well drained. It occurs on strongly sloping and moderately steep, high mountainsides. Elevations range from 7,800 to 8,500 feet. The slopes are medium or long in length. This soil formed in materials weathered mostly from sandstone. The average annual precipitation is about 30 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Yeljack loam, 15 to 30 percent slopes, Ercan loam, 3 to 15 percent slopes, and Bullnel gravelly loam, 2 to 15 percent slopes, eroded.

In a typical profile, the surface layer is dark reddish brown loam about 22 inches thick. The subsoil is dark red sandy clay loam to a depth of 60 inches or more. The surface layer is slightly acid. The subsoil is slightly calcareous and mildly alkaline in the lower part. Rock fragment content is about 15 percent in the subsoil.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly slender wheatgrass, Gambel oak, basin wildrye, mountain brome, and some bearded wheatgrass, nodding bluegrass, aspen peavine, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical in areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. If the range vegetation has seriously deteriorated, seeding is advisable. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail. Successful range seeding is influenced by seedbed preparation, depth of seeding, and time of seeding.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during summer and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, weasel, badger, red fox, and porcupine.

Because of inaccessibility, this soil is not presently used for urban or recreational developments. Septic tank absorption field problems develop in some areas because of moderately slow permeability.

These soils are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational uses of this soil are mainly hunting and snowmobiling. Capability unit VIe-H, nonirrigated.

YeE—Yeljack loam, 15 to 30 percent slopes. This Yeljack soil is deep and well drained. It occurs dominantly on north-facing, moderately steep and steep, smooth and concave high mountainsides at elevations of 6,500 to 7,600 feet. The slopes are medium or long in length. This soil formed in materials weathered from sandstone and some conglomerate. The average annual precipitation is about 25 inches, mean annual air temperature is about 41 degrees F, and the average frost-free season is about 60 days.

Included with this soil in mapping are small areas of Ercan loam, 15 to 30 percent slopes, Guilder loam, 15 to 30 percent slopes, Bullnel gravelly loam, 30 to 50 percent slopes, and Etchen very cobbly loam, 25 to 50 percent slopes.

In a typical profile, the surface layer is dark reddish brown loam about 24 inches thick. The subsoil is dark reddish brown clay loam in the upper part and dark red clay loam in the lower part and is about 31 inches thick. The substratum is red loam to a depth of 64 inches or more. This soil is neutral in the surface layer and the upper part of the subsoil. It is moderately or strongly calcareous and moderately alkaline in the lower part of the subsoil and the substratum. Rock fragment content is about 5 percent in the surface layer and 15 percent in the subsoil and substratum.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. The available water capacity is moderately high. Surface runoff is slow or medium. Erosion hazard is high.

This soil is used mainly for range, water supply, and wildlife habitat.

Potential vegetation is dominantly slender wheatgrass, basin wildrye, bearded wheatgrass, nodding bluegrass, mountain brome, aspen peavine, and antelope bitterbrush. When changes occur in the potential vegetation composition due to use by livestock or wildlife or other disturbances, certain plants increase and others decrease. Proper grazing is an important management practice for helping to maintain adequate plant cover and desired composition. Brush management is practical on areas of excessive shrubs, if a reasonable understory of desirable grasses and forbs is present. If the range vegetation has seriously deteriorated, broadcast seeding is advisable. Grasses suitable for seeding include smooth brome, Regar brome, mountain brome, slender wheatgrass, orchardgrass, or Garrison meadow foxtail.

This soil has potential for supporting plants that provide food and cover for mule deer, elk, and moose, primarily during summer and fall. It also is potential habitat for sage grouse, chukar, sharp-tailed grouse, cottontail rabbit, coyote, bobcat, weasel, badger, red fox, and porcupine. Streams in the area are potential habitat for beaver.

Because of steep slopes and inaccessibility, these soils are not used for urban or recreational developments. Septic tank absorption field problems develop in some areas because of moderately slow permeability.

These soils are important for water supply, but adequate plant cover should be maintained to keep soil losses to a minimum, thus maintaining the watershed potential.

Recreational use of this soil is mainly hunting. Capability unit VIe-H, nonirrigated.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 11,730 acres is used for crops in Morgan County. Of this, 7,230 acres is in rotation of hay, grain, and some corn for silage. About 1,300 acres is used for nonrotated meadow or pasture. About 3,200 acres is used for nonirrigated crops.

About 9,975 acres is used for crops in Ogden Valley. Of this, 7,715 acres is in rotation of hay, grain, and some corn for silage. About 2,260 acres is used for nonirrigated crops.

Practically all of the arable land in the survey area is in crops. There is some potential for increased acreage of intensive farming if the economic conditions justify their development. Farm production could be increased by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1958 there was about 1,000 acres of urban and built-up land in Morgan County, and in 1967 there was about 3,780 acres. Ogden Valley has also experienced growth in recent years. The number of homes was 490 in 1965, 610 in 1969, and 630 in 1974. Most of this urban growth has taken place in the farm lands between the towns of Huntsville, Eden, and Liberty. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map for broad land use planning."

Erosion is the major soil problem on some of the soils used for crops. If the slope is more than 3 percent, erosion is a hazard. Some Manila, Nebeker, Brownlee, Broadhead, Mondey, Kahler, and Hawkins soils have slopes of more than 3 percent and are being used for crops.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as Nebeker, Broadhead, Manila, Mondey, and Hawkins soils, and on soils with rock fragments in the underlying layer, such as Kahler soils. Erosion also reduces productivity on soils that tend to be droughty, such as Steed and Utaba soils. Second, soil erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves quality of water for municipal use, recreation, and fish and wildlife.

Effective erosion control practices must provide protective surface cover, reduce runoff, and increase water infiltration. A cropping system that keeps vegetative cover on the soil for extended periods will reduce soil erosion losses to amounts that will not diminish the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce soil erosion on sloping land and maintain or improve soil tilth. Legumes add some of the needed nitrogen.

Slopes are short and irregular, so contour tillage or terracing is not practical in most areas of moderately steep and steep Mondey, Hawkins, and Collinston soils. On these soils, a cropping system that provides maximum vegetative cover or minimum tillage is required to help to control soil erosion. Minimizing tillage and leaving crop residues on the surface help to increase water infiltration and reduce runoff and soil erosion. These practices are adapted to most soils in the survey area, but are more difficult to use successfully on eroded soils.

Terraces and diversions reduce the length of slope, runoff, and soil erosion. They are most practical on deep, well-drained soils that have regular slopes. Terraces and diversions are impractical in most areas of the Mondey, Collinston, and Hawkins soils because of their irregular or complex slopes.

Contouring and contour stripcropping are used extensively in the survey area to help to control soil erosion. These practices are impractical in most areas of the Mondey, Collinston, and Hawkins soils because of the irregular or complex slopes.

Technical information for the design, use, and application of erosion control practices for the various soils is available from local offices of the Soil Conservation Service.

Soil drainage is needed on a small acreage used for crops and pasture in the survey area. Some soils are naturally wet, so production of crops common to the area is not possible. These are the poorly drained and very poorly drained Crooked Creek and Canburn soils. They make up about 2,390 acres in the survey area.

The design of both surface and subsurface drainage systems varies with the location and kind of soil. A combination of surface drainage and tile drainage is usually needed in areas of the poorly drained soils if they are to be used for row crops. Finding adequate outlets for tile drainage systems is difficult in the areas of Crooked Creek and Canburn soils. The economic feasibility of drainage should be studied carefully due to the climatic limitation of the survey area. Effective drainage systems being considered must be carefully investigated and properly designed. Technical information on soil drainage is available from local offices of the Soil Conservation Service.

Soil fertility is moderate or moderately high on most of the soils used for crops in the survey area. The soils on flood plains such as Eastcan and Sunset soils, produce more than most of the higher positioned soils. Generally, legumes respond readily to phosphate and grasses respond readily to nitrogen fertilizer. All additions of fertilizer should be based on the result of soil tests, cropping history, crop needs, and the desired level of crop yields. Fertilizer applications should be in agreement with the latest Cooperative Extension Service and State Experiment Station recommendations.

Tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are mellow and usually granular and porous.

Soils used for crops in the survey area mostly have a loam surface layer that is dark in color and moderate in content of organic matter. Generally the tilth of such soil is good. Regular additions of crop residues, manure, and other organic material help to maintain and improve the soil tilth and water infiltration rate. Fall plowing is generally beneficial to soil tilth and facilitates seedbed preparation. If wet when plowed, Nebeker, Broadhead, and Hawkins soils tend to be very cloddy when dry, so a good seedbed is difficult to prepare. The Steed, Utaba, Phoebe, and Redola soils are suitable for spring plowing.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn is the principal row crop. Sugar beets, potatoes, cabbage, lettuce, carrots, and peas can be grown.

Wheat, barley, and alfalfa are the common close-growing crops.

The soils of the Morgan and Ogden Valleys are in low positions where frost is frequent in late spring and early fall. The air drainage is poor and the climate is too severe for early vegetables, small fruits, or orchards.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Capability classification

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into considera-

tion possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs (5). A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 2. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The *capability unit* is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

In the Utah system a number or letter is used to suggest the chief kinds of limitation of the soils in that capability unit. The number *2* or *3* in the first position shows the climate. The number *2* means a climate with 100 to 140 frost-free days, and *3* means climate with 70 to 100 frost-free days. The letters *U*, *M*, and *H* in the first position are for nonirrigated capability units and show the range of average annual precipitation. The letter *U* (upland) means 12 to 16 inches, *M* (mountain) means 16 to 22 inches, and *H* (high mountain) means 22 to 35 inches or more. Additional numbers or letters are used to show limitations as follows: *2* means overflow or inadequate surface drainage, *3* means inhibiting layer, *4* means low water holding capacity (gravelly or cobbly soils), *5* means slow permeability, *6* means low water holding capacity (sandy soils), *X* means coarse fragments on the surface, *E* means erosion hazard, *A* means aspen, *C* means conifer, *J* means juniper, *Q* means oakbrush vegetation, and *Z* means deficient moisture.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 3. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 3.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of

nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 3 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Range

Range is an important resource in the survey area. Approximately 584,115 acres, or 94 percent of the survey area, is used for range. Perennial grasses, shrubs, and forbs are the dominant vegetation, but some areas support a cover of aspen, maple, oak, and coniferous trees. Woodland areas are used to some extent for grazing.

The total area in range includes about 2,400 acres of semiwet meadow pastures. These pastures are used principally for range, but some of the grasses are cut for meadow hay.

Range is used primarily for grazing by sheep and cattle in spring, summer, and fall. Most of the range is on slopes of 30 percent or more and is better suited to sheep than to cattle. The sheep are wintered on the deserts of western Utah or eastern Nevada. The cattle are wintered in the areas of irrigated crops, and their feed is supplemented by the forage and small grains harvested from these fields. Water is generally adequate and is supplied by streams and developed springs and seeps. Stock watering ponds, livestock trails, and pasture fencing are important practices for obtaining proper livestock distribution over the range.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered by shrubs and annuals. The amounts of grazable forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 4 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 4.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plants—grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil—are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natu-

ral plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on most of the range is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Controlling brush and undesirable shrubs is also important. If sound range management based on the soil survey information and range inventories is applied, the potential for increasing the productivity of range in the area is good.

Plants growing on the range in different parts of the survey area are affected not only by the differences in the kinds of soil but also by differences in the average annual temperature and in the length of the growing season. These factors all influence the kinds and amounts of vegetation produced. The three types of climate in the survey area are the Mountain climatic regime, the High Mountain climatic regime and the Semiwet climatic regime.

Mountain climatic regime.—In this regime the average annual precipitation ranges from 18 to 22 inches and occurs mostly as snow. Precipitation in summer contributes little to plant growth. The growing season is from about April 15 to July 31, or until moisture is depleted or plants mature. If moisture is available, some plants grow until late in summer or early in fall. Mountain range sites are on all exposures and slopes. The elevation ranges from 5,100 to 8,200 feet. The mean annual air temperature is about 43 degrees F.

Seven range sites are in the Mountain climatic regime. These are the Mountain Shallow Loam, Mountain Loam (Shrubs), Mountain Gravelly Loam (Oak), Mountain Gravelly Loam, Mountain Loam (Oak), Mountain Stony Loam, Mountain Clay, and Mountain Shallow Loam (Curlleaf Mountainmahogany).

High Mountain climatic regime.—In this regime the average annual precipitation ranges from 22 to 35 inches and occurs mostly as snow. The growing season is from May 15 to about September 20 or until a killing frost in the fall. High Mountain sites are on all exposures and slopes. The elevation ranges from about 6,000 to 9,200 feet. The mean annual air temperature ranges from 41 to 44 degrees F.

Five range sites are in the High Mountain climatic regime. These are the High Mountain Loam (Shrub), High Mountain Loam (Aspen), High Mountain Loam, High Mountain Clay, and High Mountain Stony Clay.

Semiwet climatic regime.—In this regime the soils are wet because they receive run-in water or have a high water table. In these areas, the climate is characterized by cold, snowy winters and dry summers. The average annual precipitation ranges from 18 to 20 inches. Much of the water available to plants is run-in from adjacent irrigated land or is from the water table. The growing season is from about May 1 to September 1 or until frost. The frost-free season is about 90 to 105 days. The mean annual air temperature is about 44 to 46 degrees F.

The two range sites in the Semiwet climatic regime are Wet Meadows and Semiwet Stream Bottoms.

Woodland management and productivity

Wood products are harvested from only a comparatively small acreage in the survey area. The trees that are usable for wood products are mainly Douglas-fir, white fir, and aspen. About 18 percent of the survey area, or 107,901 acres, has a cover of aspen. About 3 percent, or 18,420 acres, has a cover of conifers. The soils in woodland are generally too steep and occur at high elevations where the climate is too cold for cultivated crops.

Soil properties have a strong influence on tree species, adaptation, and growth and on woodland management. Differences in texture and depth of the soil material affect the available water capacity and therefore influence tree growth. Slope and aspect also affect tree growth and the way woodland is managed.

As a rule, trees grow fastest and tallest on the more productive soils. Tree growth is about the same on soils that have similar properties, so similar soils are grouped for woodland management. A group consists of soils that have comparable potential productivity and limitations, that produce similar trees, and that require similar management.

Table 5 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 5 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are

needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

The common names of major understory plants that grow on specified soils are given in the appropriate descriptions of map units.

Wildlife habitat

Most soils in the survey area support vegetation that is used by wildlife to some extent. However, species of wildlife are not confined to areas of a particular soil or group of soils. The presence of wildlife in a given area depends on the availability of food, water, and cover.

The mountainous lands of the survey area provide habitat for mule deer. Elk are found mainly on Herd Mountain, Lost Creek drainage, and the South Fork and Middle Fork of the Ogden River drainage. A herd of moose is located generally in the South Fork of the Ogden River drainage or Lost Creek drainage. The lands in the Morgan Area are very popular hunting areas for these big game animals.

Natural streams in the survey area provide fishing for local residents and tourists. Some streams are used for fishing the year around. Rainbow, brown, brook, and cutthroat trout reproduce naturally in streams and reservoirs, and this supply is supplemented by stocking. Catfish, suckers, and whitefish are also important species. Some privately owned fish ponds are in the area.

The natural streams also provide habitat for beaver and muskrat.

Sage grouse, chukar, sharp-tailed grouse, mourning dove, and Hungarian partridge are popular game birds throughout the mountain zone of the survey area. A few pheasant are found in the Ogden and Morgan Valleys. Ruffed grouse and blue grouse are found in the areas of aspen or conifer overstory.

Bobcat, porcupine, red fox, coyote, snowshoe hare, and jackrabbit are also found throughout the survey area. Occasionally a brown bear is seen in the survey area.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 6, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect

management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland wildlife habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland wildlife habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Wetland wildlife habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland wildlife habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, white-tailed deer, desert mule deer, sage grouse, meadowlark, and lark bunting.

Recreation

The lands in this survey area are very popular hunting areas for big game animals—deer, elk, and moose. Popular game birds found in this survey area are chukar, Hungarian partridge, sage grouse, ruffed grouse, blue grouse, and mourning dove. The streams in the area are popular for fishing.

The four major reservoirs in the survey area are Pineview, Causey, Lost Creek, and East Canyon. They are very popular boating, water skiing, fishing, and swimming areas. The lands adjoining the reservoirs provide areas for camping and picnicking. These waters are used by thousands of residents and tourists each year.

The canyons throughout the survey area are popular horseback riding trails and are popular during the winter season for snowmobilers.

Snow Basin, Nordic Valley, and Powder Mountain are snow skiing resorts in the survey area. At present time plans are being made for an additional snow skiing resort complex near Snow Basin. Nordic Valley, Patio Springs, and Round Valley Resort are popular golf courses.

Many campgrounds and picnic areas are along the South Fork of the Ogden River. These are administered by the Forest Service. Many areas have been subdivided for summer homes. These areas are mainly in oak, maple, aspen, or conifer forest and often afford beautiful views of the surrounding mountains and valleys.

It is anticipated that further emphasis will be placed on the lands of this survey areas for all types of recreation.

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, founda-

tions for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 11, for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 12 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 12.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil

blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 12 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 12 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 12 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use (*3*) are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Also in table 12 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are

based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 13 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 13. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 14 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 14 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on

measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Agassiz series

The Agassiz series consists of shallow, somewhat excessively drained soils that formed in material weathered from limestone. Agassiz soils are on mountainsides and canyon walls and have slopes of 40 to 70 percent. Mean annual precipitation is about 20 inches, and the mean annual air temperature is about 43 degrees F.

Agassiz soils are similar to the Foxol and Wallsburg soils. They are near Geertsen soils. Foxol soils are slightly acid to medium acid. Wallsburg soils have more than 35 percent clay in the B2t horizon. Geertsen soils are 48 to more than 60 inches deep over bedrock, are on northern exposures, and have cooler summer temperatures.

Typical pedon of Agassiz stony silt loam in an area of Agassiz-Rock outcrop complex, 40 to 70 percent slopes, in Weber County, about 1 mile north and 1/4 mile east of Causey Dam, 1,400 feet south and 1,500 feet east of northwest corner of section 26, T. 7 N., R. 3 E.:

A11—0 to 3 inches; dark brown (10YR 3/3) stony silt loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; 5 percent stones, 35 percent cobbles, 15 percent gravel; slightly acid (pH 6.2); clear wavy boundary. (1 to 5 inches thick)

A12—3 to 8 inches; dark brown (10YR 3/3) very cobbly silt loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure that parts to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; 40 percent cobbles, 15 percent gravel; slightly acid (pH 6.4); gradual wavy boundary. (4 to 5 inches thick)

B2—8 to 14 inches; brown (7.5YR 4/4) very cobbly silt loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and very fine roots; many fine pores; 60 percent cobbles, 10 percent gravel; neutral (pH 6.8); abrupt irregular boundary. (0 to 13 inches thick)

R—14 inches; limestone bedrock.

The mollic epipedon is 7 to 19 inches thick. The soil is 10 to 20 inches deep over bedrock. Rock fragments consist of angular gravel, cobbles, and stones and make up 20 to 60 percent of the A1 horizon and 35 to 70 percent of the B horizon. Reaction ranges from slightly acid to moderately alkaline, but is dominantly slightly acid or neutral. The soil is noncalcareous to moderately calcareous.

The A1 horizon has hue of 10YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is stony or very cobbly silt loam and stony, cobbly, gravelly, or very gravelly loam. The B2 horizon is not present in all pedons. The B2, where present, has hue of 10YR or 7.5YR, value of 4 through 6 dry and 3 or 4 moist, and chroma of 3 or 4. It is very cobbly or cobbly heavy silt loam and gravelly, cobbly, or very cobbly heavy loam.

Ant Flat series

The Ant Flat series consists of deep and very deep, well drained soils that formed in material weathered from sandstone. Ant Flat soils are on gently rolling mountainsides at elevations of 5,300 to 7,500 feet. Slopes are 6 to 15 percent. Average annual precipitation is about 22 inches, and the mean annual air temperature is about 42 degrees F.

Ant Flat soils are similar to Manila soils. Manila soils lack a horizon of calcium carbonate accumulation above a depth of 40 inches.

Typical pedon of Ant Flat loam in an area of Ant Flat loam, 6 to 15 percent slopes, in Weber County about 7 1/2 miles north and 3/4 mile west of Causey Dam, 200 feet east and 400 feet north of the southwest corner of section 22, T. 8 N., R. 3 E.:

A1—0 to 7 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 4/2) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine and few medium roots; neutral (pH 6.8); clear smooth boundary. (7 to 9 inches thick)

B1—7 to 10 inches; dark brown (7.5YR 3/3) light clay loam, brown (7.5YR 4/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and very plastic; common fine and very fine and few medium roots; many fine and very fine pores; neutral (pH 6.8); clear wavy boundary. (0 to 3 inches thick)

B2t—10 to 26 inches; yellowish red (5YR 4/6) heavy clay loam, red (2.5YR 4/6) dry; moderate medium and coarse prismatic structure that parts to strong medium and fine subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine, fine, and medium roots; many fine and very fine pores; many thin clay

films on faces of peds and in pores; neutral (pH 6.8); clear wavy boundary. (16 to 24 inches thick)

C1ca—26 to 35 inches; yellowish red (5YR 4/6) clay loam, light reddish brown (2.5YR 6/4) dry; weak medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; many fine and very fine pores; strongly calcareous; lime is veined; mildly alkaline (pH 7.6); gradual wavy boundary. (9 to 12 inches thick)

C2—35 to 60 inches; red (2.5YR 5/8) clay loam, red (2.5YR 5/6) dry; massive; very hard, friable, sticky and plastic; many fine and very fine pores; moderately calcareous; lime is veined; mildly alkaline (pH 7.6).

The mollic epipedon is 10 to 17 inches thick. The combined thickness of the A1 and B2t horizons is 26 to 33 inches. Depth to the horizon of lime accumulation is also 26 to 33 inches. Depth to sandstone bedrock is 40 to 60 inches or more. Reaction is slightly acid or neutral in the A1 and B2t horizons. Rock fragments are gravel and make up 0 to 15 percent of the A1 and B2t horizons and 0 to 30 percent of the C horizon.

The A1 horizon has hue of 7.5YR and 10YR, value of 3 or 4 dry and 3 moist and chroma of 2 through 4 dry and 2 or 3 moist. It is loam or heavy loam. The B2t horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 6 dry and 2 through 6 moist. It is heavy clay loam, heavy silty clay loam, or silty clay. The Cca horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 through 8 dry and 3 through 7 moist, and chroma of 3 through 8 dry and 4 through 8 moist. It is clay loam or gravelly clay loam. The C horizon is strongly calcareous and mildly alkaline to strongly alkaline.

Bertag series

The Bertag series consists of very deep, well drained soils that formed in material weathered from tuffaceous sandstone. Bertag soils are on foothills and mountainsides at elevations of 5,200 to 7,200 feet and have slopes of 10 to 50 percent. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 43 degrees F.

Bertag soils are similar to Donner and Hawkins soils. They are near Causey, Donner, Hawkins, Manila, and Ostler soils. All of these have a dark surface layer less than 20 inches thick. Donner soils have soft bedrock at a depth of 20 to 40 inches. Hawkins, Causey, and Ostler soils all lack a B2t horizon.

Typical pedon of Bertag silt loam in an area of Bertag silt loam, 30 to 50 percent slopes, about 2 miles south and 1 mile west of Huntsville, 1,500 feet west and 600 feet south of northeast corner of section 26, T. 6 N., R. 1 E.:

O1—2 inches to 0; matted, decaying leaves and twigs.

A11—0 to 11 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; slightly acid (pH 6.4); gradual smooth boundary. (4 to 13 inches thick)

A12—11 to 24 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure that parts to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; slightly acid (pH 6.2); gradual wavy boundary. (0 to 16 inches thick)

B21t—24 to 35 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few fine, medium, and coarse roots; many very fine and fine pores; common thin clay films; slightly acid (pH 6.2); gradual irregular boundary. (6 to 14 inches thick)

B22t—35 to 52 inches; very dark grayish brown (2.5Y 3/2) heavy silty clay loam, grayish brown (2.5Y 5/2) dry; moderate medium subangular blocky structure; very hard, firm, sticky and very plastic; few fine, medium, and coarse roots; many very fine and fine pores; many thin clay films; medium acid (pH 5.8); diffuse irregular boundary. (6 to 18 inches thick)

B23t—52 to 60 inches; dark grayish brown (2.5Y 4/2) heavy silty clay loam, pale brown (10YR 6/3) dry; moderate medium and coarse subangular blocky structure; very hard, friable, sticky and very plastic; few fine and medium roots; common fine pores; common thin clay films; medium acid (pH 6.0).

The dark colored surface layer is 20 to 38 inches thick. The combined thickness of the A1 and B2t horizons is 51 to more than 66 inches. Rock fragments make up 0 to 30 percent of the A1 horizon and 0 to 25 percent of the B2t and C horizons. Base saturation is less than 75 percent in some or all parts of the upper 30 inches. Reaction is medium acid and slightly acid in the B2t horizon.

The A1 horizon has value of 2 or 3 moist and 2 through 4 dry and chroma of 1 or 2 moist and 2 or 3 dry. It is silt loam, loam, or cobbly loam. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 2 through 5 moist and 3 through 6 dry, and chroma of 2 through 4 moist and dry. It is heavy silty clay loam, silty clay, heavy clay loam, clay, or gravelly silty clay. Some pedons have a C horizon below a depth of 51 inches. Texture is clay, sandy clay, silty clay loam, or loam and is gravelly or cobbly in some pedons.

Broad Canyon series

The Broad Canyon series consists of very deep, well drained soils that formed in material weathered from quartzite, argillite, phyllite, and schist. Broad Canyon soils are on very steep, north-facing high mountainsides at elevations of 6,500 to 9,000 feet. Slopes range from 30 to 70 percent. The average annual precipitation is about 35 inches, and the mean annual air temperature is about 42 degrees F.

Broad Canyon soils are near Agassiz, Foxol, Geertsen, Lucky Star, Poleline, and Moweba soils. Agassiz and Foxol soils have bedrock at a depth of less than 20 inches. Poleline and Moweba soils have a mollic epipedon more than 20 inches thick. Lucky Star soils have A2 and B2t horizons. Geertsen soils have an argillic horizon.

Typical pedon of Broad Canyon stony loam in an area of Broad Canyon stony loam, 30 to 70 percent slopes, about 8 miles northeast of Causey Dam, 800 feet north and 200 feet east of southwest corner of section 12, T. 7 N., R. 4 E.:

O1—1 to 0 inch; matted decaying conifer needles, twigs, etc.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) stony loam, brown (10YR 4/3) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; 40 percent cobbles and gravel; 10 percent of surface covered by stones; slightly acid (pH 6.4); clear wavy boundary. (4 to 10 inches thick)

A12—4 to 9 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 4/3) dry; weak medium subangular blocky structure that parts to weak fine granular; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; common fine and very fine pores; 70 percent cobbles and gravel; slightly acid (pH 6.4); clear wavy boundary. (5 to 12 inches thick)

A13—9 to 15 inches; dark brown (10YR 3/3) very cobbly loam, pale brown (10YR 5/3) dry; weak medium and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine and very fine

pores; 70 percent cobbles and gravel; slightly acid (pH 6.4); gradual wavy boundary. (0 to 6 inches thick)

B2—15 to 30 inches; brown (7.5YR 5/4) very cobbly loam, very pale brown (10YR 7/3) dry; weak medium and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; 70 percent cobbles and gravel; slightly acid (pH 6.4); diffuse irregular boundary. (6 to 17 inches thick)

C—30 to 60 inches; brown (7.5YR 5/4) very cobbly sandy loam, very pale brown (10YR 7/4) dry; single grained; loose; few fine, medium, and coarse roots; 80 percent cobbles and gravel; slightly acid (pH 6.4).

The mollic epipedon is 14 to 16 inches thick. The combined thickness of the A1 and B2 horizon is 20 to 38 inches. Rock fragments consist of gravel, cobbles, and some stones; they make up 25 to 70 percent of the A1 and B2 horizons and 60 to 80 percent of the C horizon. Reaction is slightly acid to medium acid.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 through 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is stony loam at the surface and ranges from very cobbly, cobbly, gravelly, or very gravelly loam to gravelly silt loam. The B2 horizon has hue of 10YR or 7.5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is very cobbly loam, gravelly silt loam, very gravelly fine sandy loam, or very cobbly fine sandy loam. The C horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 through 7 dry and 4 through 6 moist, and chroma of 3 through 6 dry and 4 through 6 moist. It is very cobbly sandy loam, very gravelly fine sandy loam, gravelly loamy sand, or very gravelly loamy fine sand.

Broadhead series

The Broadhead series consists of very deep, well drained soils that formed in material weathered from sandstone, quartzite, or limestone. Broadhead soils are on stream terraces or alluvial fans at elevations of 5,200 to 5,400 feet. Slopes range from 2 to 5 percent. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

Broadhead soils are similar to Cristo, Henefer, and Nebeker soils. They are near Eastcan, Pringle, and Utaba soils. Cristo soils have bedrock at a depth of 29 to 35 inches. Henefer soils have hue of 5YR and 2.5YR in the B2t horizon. Nebeker soils have mean annual soil temperature warmer than 47 degrees F. Eastcan, Pringle, and Utaba soils all lack a B2t horizon and have less than 35 percent clay in the layer between depths of 10 and 40 inches.

Typical pedon of Broadhead clay loam in an area of Broadhead clay loam, 2 to 5 percent slopes, about 1/2 mile southwest of Croydon, 2,300 feet south and 1,700 feet west of northeast corner of section 20, T. 4 N., R. 4 E.:

Ap—0 to 6 inches; dark brown (7.5YR 3/2) clay loam, brown (7.5YR 4/2) dry; moderate medium granular structure; hard, firm, very sticky and very plastic; few very fine, fine, medium, and coarse roots; moderately calcareous; mildly alkaline (pH 7.8); clear smooth boundary. (6 to 9 inches thick)

A12—6 to 17 inches; dark brown (7.5YR 3/2) clay loam, brown (7.5YR 4/2) dry; weak medium and coarse subangular blocky structure parting to moderate medium granular structure; hard, firm, very sticky and very plastic; few very fine, fine, medium, and coarse roots; noncalcareous; neutral (pH 6.8); clear smooth boundary. (0 to 13 inches thick)

B21t—17 to 26 inches; dark brown (7.5YR 3/2) silty clay, brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine, fine, and medium roots; few very fine pores; common thin and few moderately thick clay films on peds; noncalcareous; neutral (pH 6.6); clear smooth boundary. (9 to 11 inches thick)

B22t—26 to 43 inches; dark brown (7.5YR 4/2) silty clay, brown (7.5YR 4/4) dry; weak medium prismatic structure parting to moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine, fine, and medium roots; few very fine pores; many thin and common moderately thick clay films on peds; neutral (pH 7.3); clear smooth boundary. (7 to 27 inches thick)

B3tca—43 to 50 inches; reddish brown (5YR 4/4) clay loam, brown (7.5YR 5/4) dry; weak medium and coarse subangular blocky structure; hard, firm, very sticky and plastic; few very fine roots; common very fine pores; common moderately thick clay films on peds; strongly calcareous; veins of lime; moderately alkaline (pH 8.2); clear smooth boundary. (7 to 15 inches thick)

Cca—50 to 60 inches; dark reddish brown (5YR 3/4) clay loam, pink (7.5YR 7/4) dry; weak medium subangular blocky structure; hard, firm, very sticky and plastic; few very fine roots; few very fine pores; strongly calcareous; veins of lime; moderately alkaline (pH 8.4).

The mollic epipedon is 26 to 48 inches thick. The combined thickness of the A1, B2t, and B3tca horizons is 35 to 50 inches. The A1 horizon is dominantly noncalcareous, but it is moderately calcareous in the upper part in the vicinity of Croydon. Reaction is neutral to slightly acid in the A1 horizon. The B2t horizon is neutral. The B3tca horizon is moderately to strongly calcareous and neutral to mildly alkaline. The Cca horizon is strongly calcareous and mildly alkaline to moderately alkaline.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is clay loam or silty clay loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 through 4 dry and moist. It is silty clay, clay, or heavy clay loam with more than 35 percent clay. The B3tca horizon has hue of 5YR, 7.5YR, or 10YR and chroma of 4 dry and 3 or 4 moist. It is light clay loam or silty clay loam. The Cca horizon has hue of 5YR, value of 5 through 7 dry and 3 or 4 moist, and chroma of 4 dry and 3 or 4 moist. It is heavy clay loam or loam.

Brownlee series

The Brownlee series consists of very deep, well drained soils that formed in materials weathered from argillite, phyllite, schist, and some quartzite. Brownlee soils are on nearly level or gently sloping lake terraces and stream terraces at elevations of 4,800 to 5,150 feet. Slopes range from 0 to 8 percent, but are dominantly 0 to 6 percent. The average annual precipitation is about 21 inches, and the mean annual air temperature is 46 degrees F.

Brownlee soils are near Crooked Creek, Lamondi, Manila, Nicodemus, and Phoebe soils. Crooked Creek, Nicodemus, and Phoebe soils lack a B2t horizon. Crooked Creek soils have more than 35 percent clay in the layer between depths of 10 and 40 inches and have mottles associated with wetness. Nicodemus soils have a mollic epipedon more than 20 inches thick and have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Phoebe soils have less than 18 percent clay in the layer at depths between 10 and 40 inches. Lamondi soils have a mollic epipedon more than 20 inches thick. Manila soils have more than 35 percent clay in the B2t horizon.

Typical pedon of Brownlee loam in an area of Brownlee loam, 0 to 3 percent slopes, about 1 block south of Eden

Church, 900 feet east and 1,800 feet north of the southwest corner of section 35, T. 7 N., R. 1 E.:

Ap1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate fine and medium granular structure; hard, friable, slightly sticky and plastic; common very fine and medium roots; slightly acid (pH 6.1); abrupt smooth boundary. (3 to 6 inches thick)

Ap2—3 to 10 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine, fine, and medium roots; few very fine, fine, and medium pores; slightly acid (pH 6.1); clear smooth boundary. (0 to 7 inches thick)

B21t—10 to 18 inches; dark brown (10YR 3/3) clay loam, yellowish brown (10YR 5/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; few very fine, fine, and medium pores; many thin clay films on peds and in pores; medium acid (pH 6.0); gradual wavy boundary. (8 to 10 inches thick)

B22t—18 to 30 inches; dark brown (10YR 4/3) clay loam, yellowish brown (10YR 5/4) dry; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few very fine, fine, and medium pores; many thin clay films on peds and in pores; medium acid (pH 6.0); gradual wavy boundary. (6 to 17 inches thick)

B23t—30 to 46 inches; dark grayish brown (2.5Y 4/2) clay loam, light olive brown (2.5Y 5/4) dry; moderate medium and coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine pores; common thin clay films on peds; medium acid (pH 5.6); abrupt smooth boundary. (0 to 16 inches thick)

C—46 to 63 inches; dark grayish brown (10YR 4/2) loamy sand, yellowish brown (10YR 5/4) dry; single grained; loose; few very fine roots; medium acid (pH 5.6).

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1 and B2t horizons is 36 to 50 inches. Rock fragments are dominantly angular gravel and make up 0 to 25 percent of the A1 horizon, 0 to 15 percent of the B2t horizon, and 0 to 25 percent of the C horizon. Base saturation ranges from 50 to 70 percent in some part of the soil above a depth of 30 inches. Reaction is slightly acid in the A1 horizon and slightly to medium acid in the B2t and C horizons.

The A1 horizon has hue of 10YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam or gravelly loam. The B2t horizon has hue of 10YR or 2.5Y, value of 3 through 6 dry and 3 or 4 moist, and chroma of 3 through 6 dry and 2 through 4 moist. It is clay loam or loam. The C horizon has hue of 10YR or 2.5YR, value of 5 or 6 dry and 3 through 5 moist, and chroma of 1 through 6 dry and 2 through 6 moist. The C horizon is dominantly stratified loamy sand, loam, gravelly loam, or silt loam.

Bullnel series

The Bullnel series consists of moderately deep, well drained soils that formed in materials weathered from sandstone. Bullnel soils are on north-facing, even or concave mountainsides and on ridgetops. Elevations are 6,500 to 8,000 feet. They have slopes of 2 to 50 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 40 degrees F.

Bullnel soils are similar to Kilfoil soils. They are near Ercan, Etchen, and Guilder soils. Kilfoil soils have hue of 10YR, 2.5Y, and 5Y in the B2t horizon. Ercan soils are more than 40 inches deep to bedrock, have an A2 horizon, and have less than 20 percent rock fragments in the B2t horizon. Etchen soils have more than 35 percent rock fragments in the B2t horizon. Guilder soils are more than 40 inches deep and have less than 20 percent rock fragments in the B2t horizon.

Typical pedon of a Bullnel gravelly loam in an area of Bullnel gravelly loam, 30 to 50 percent slopes, about 10 miles north and 3 miles east of Lost Creek Dam, 1,650 feet east and 100 feet north of southwest corner of section 13, T. 7 N., R. 5 E.:

A11—0 to 1 1/2 inches; dark reddish brown (5YR 2/2) loam, dark reddish brown (5YR 3/4) dry; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; 10 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary. (1 to 8 inches thick)

A12—1 1/2 to 8 inches; dark reddish brown (5YR 3/4) gravelly loam, reddish brown (5YR 4/4) dry; weak coarse granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 30 percent gravel and cobbles; slightly acid (pH 6.2); clear irregular boundary. (0 to 8 inches thick)

B21t—8 to 13 inches; reddish brown (5YR 4/4) gravelly loam, yellowish red (5YR 5/6) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common fine pores; many thin clay films on peds; 30 percent gravel and cobbles; slightly acid (pH 6.4); clear wavy boundary. (5 to 10 inches thick)

B22t—13 to 34 inches; dark red (2.5YR 3/6) gravelly silty clay loam, yellowish red (5YR 5/6) dry; weak medium prismatic structure parting to moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine pores; continuous thin and few moderately thick clay films on peds; 25 percent soft angular gravel and cobbles; moderately calcareous; mildly alkaline (pH 7.8); clear wavy boundary. (7 to 25 inches thick)

C—34 to 39 inches; dark red (2.5YR 3/6) gravelly loam, yellowish red (5YR 5/8) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, slightly sticky and slightly plastic; few very fine roots; 30 percent soft angular gravel and cobbles; strongly calcareous; moderately alkaline (pH 8.0); abrupt wavy boundary. (0 to 7 inches thick)

R—39 to 41 inches; weathered sandstone.

The combined thickness of the A1 and B2t horizons ranges from 13 to 34 inches. Soft weathered sandstone bedrock is at a depth of 21 to 40 inches. Rock fragments consist of sandstone gravel and cobbles and make up 0 to 30 percent of the A1 horizon, 20 to 35 percent of the B2t horizon, and 25 to 60 percent of the C horizon.

The A1 horizon has hue of 2.5YR, 5YR, and 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 4 through 6 dry and 2 through 4 moist; texture is loam or gravelly loam. The A1 horizon is mainly slightly to moderately calcareous, but is noncalcareous in some pedons. It is mainly mildly to moderately alkaline, but is slightly acid or neutral in some pedons. The B2t horizon has hue of 10R, 2.5YR, and 5YR, value of 5 or 6 dry and 3 through 5 moist, and chroma of 4 through 6 dry and moist. It is gravelly heavy loam, silty clay loam, clay loam, or sandy clay loam with 20 to 35 percent rock fragments. The B2t horizon is noncalcareous in the upper part and moderately to strongly calcareous in the lower part and is mildly alkaline through strongly alkaline. The C horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 5 through 8 dry and moist.

Burgi series

The Burgi series consists of deep or very deep, well drained soils that formed in materials weathered from limestone. Burgi soils are on very steep, north- and east-facing mountainsides at elevations of 5,600 to 7,600 feet. Slopes are 40 to 70 percent. Average annual precipitation is about 22 inches, and the mean annual air temperature is about 42 degrees F.

Burgi soils are similar to Poleline and St. Marys soils. They are near Agassiz, Geertsen, and Horrocks soils. Poleline soils have summer soil temperatures of less than 59 degrees F. St. Marys soils have a mollic epipedon less than 20 inches thick. Agassiz soils have bedrock at a depth of less than 20 inches. Geertsen soils have a mollic epipedon less than 16 inches thick, a B2t horizon, and summer soil temperatures of less than 59 degrees F. Horrocks soils have a mollic epipedon less than 20 inches thick, and a B2t horizon.

Typical pedon of Burgi loam in an area of Burgi loam, 40 to 70 percent slopes, in Morgan County, about 3 miles north and 1 mile east of Morgan County Courthouse at a point 2,200 feet west and 1,100 feet north of the southeast corner of section 18, T. 4 N., R. 3 E.:

A11—0 to 4 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent angular gravel and 5 percent angular cobbles; slightly acid (pH 6.4); clear smooth boundary. (4 to 11 inches thick)

A12—4 to 10 inches; very dark brown (10YR 2/2) cobbly loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; 15 percent angular gravel and 15 percent angular cobbles; slightly acid (pH 6.4); clear smooth boundary. (6 to 18 inches thick)

A13—10 to 20 inches; very dark brown (10YR 2/2) cobbly loam, dark brown (10YR 3/3) dry; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; 15 percent angular gravel and 20 percent angular cobbles; neutral (pH 6.6); clear smooth boundary. (0 to 10 inches thick)

C1—20 to 25 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular structure; slightly hard, friable, sticky and slightly plastic; common very fine and fine and few medium roots; common micro and few fine pores; 10 percent angular gravel, 30 percent angular cobbles; neutral (pH 6.6); gradual irregular boundary. (5 to 16 inches thick)

C2—25 to 44 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and slightly plastic; few very fine and fine roots; common micro and few fine pores; 10 percent angular gravel, 40 percent angular cobbles, 3 percent stones; noncalcareous; some fine flecks of lime and thin coatings of lime on undersides of rock fragments; moderately alkaline (pH 8.2); gradual wavy boundary. (7 to 19 inches thick)

C3—44 to 60 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few very fine and fine roots; common micro and few fine pores; 20 percent angular gravel, 50 percent angular cobbles, 3 percent angular stones; strongly calcareous; disseminated lime with thick lime coating on undersides of rock fragments; moderately alkaline (pH 8.4).

The mollic epipedon is 28 to 56 inches thick. Fractured bedrock is at a depth of 47 to more than 60 inches. Rock fragments are angular gravel, cobbles, and stones; they make up 5 to 35 percent of the A1 horizon, 35 to 40 percent of the upper part of the C horizon, and 50 to 75 percent of the lower part of the C horizon. The layer between depths of 10 and 40 inches averages 35 to 50 percent rock fragments. Reaction is slightly acid to neutral in the A1 horizon and in the upper part of the C horizon, and moderately alkaline in the lower part of the C horizon. The soil is moderately to strongly calcareous below a depth of about 40 inches.

The A1 horizon has hue of 10YR, value of 2 or 3 moist and 3 or 4 dry, and chroma of 2 moist and 2 or 3 dry. It is loam in the upper 4 to 11 inches and loam, cobbly loam, or gravelly loam below. The upper 5 to 16 inches of the C horizon has hue of 10YR or 7.5YR, value of 3 through 5 moist and 4 or 5 dry, and chroma of 2 through 4 moist and 3 or 4 dry. Texture is cobbly or gravelly loam. The lower part of the C horizon has hue of 10YR, value of 3 through 5 dry and 4 through 6 moist, and chroma of 2 through 4 dry and moist. It is very cobbly or very gravelly loam.

Caballo series

The Caballo series consists of deep, well drained soils that formed in materials weathered from limestone. Caballo soils are on very steep, north-facing high mountainsides at elevations of 7,000 to 9,200 feet. Slopes range from 40 to 70 percent, but are dominantly 60 to 70 percent. Average annual precipitation is about 35 inches, and the mean annual air temperature is about 39 degrees F.

Caballo soils are similar to Nagitsy and Poleline soils. They are near Agassiz, Burgi, Condie, and Geertsen soils. Nagitsy soils have bedrock at a depth of 20 to 40 inches. Poleline soils have less than 18 percent clay in the layer between depths of 10 and 40 inches. Agassiz soils are on warmer, southern exposures and have bedrock at a depth of less than 20 inches. Burgi soils have warmer soil temperatures of more than 59 degrees F. Condie soils lack a mollic epipedon and have A2 and B2t horizons. Geertsen soils have a mollic epipedon less than 16 inches thick, and have a B2t horizon.

Typical pedon of Caballo gravelly loam in an area of Caballo gravelly loam, 40 to 70 percent slopes, about 8 miles north of Morgan County Courthouse at a point 1,900 feet north and 1,000 feet west of the southeast corner of section 24, T. 5 N., R. 2 E.:

O1—1 inch to 0; needles and leaves.

A11—0 to 2 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (10YR 3/3) dry; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and medium roots;

15 percent gravel, 10 percent cobbles; slightly acid (pH 6.1); clear smooth boundary. (2 to 6 inches thick)

A12—2 to 10 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark brown (10YR 4/3) dry; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; many fine and medium and few coarse roots; 15 percent gravel, 10 percent cobbles; slightly acid (pH 6.1); gradual wavy boundary. (8 to 12 inches thick)

A13—10 to 22 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark brown (7.5YR 4/2) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; few very fine pores; 40 percent cobbles, 20 percent gravel; slightly acid (pH 6.5); gradual wavy boundary. (0 to 12 inches thick)

C1—22 to 36 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 4/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; few very fine pores; 10 percent stones, 60 percent cobbles, 20 percent gravel; slightly calcareous, lime disseminated; mildly alkaline (pH 7.8); gradual wavy boundary. (11 to 14 inches thick)

C2—36 to 46 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 4/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; few very fine pores; 10 percent stones, 60 percent cobbles, 20 percent gravel; moderately calcareous, lime disseminated; moderately alkaline (pH 8.0); gradual wavy boundary. (5 to 10 inches thick)

C3—46 to 53 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 4/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; 10 percent stones, 40 percent cobbles, 40 percent gravel; moderately calcareous, lime disseminated; moderately alkaline (pH 8.2); abrupt irregular boundary. (0 to 10 inches thick)

R—53 inches; fractured bedrock.

The mollic epipedon is 35 to 53 inches thick. Depth to bedrock is 40 to 53 inches or more. Rock fragments consist of gravel, cobbles, and some stones; they make up 25 to 30 percent of the upper part of the A1 horizon, 55 to 60 percent of the lower part, and 55 to 90 percent of the C horizon. The reaction is slightly acid or neutral in the A1 horizon and mildly alkaline or moderately alkaline in the C horizon. The C horizon is noncalcareous through strongly calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 or 3 moist and 3 or 4 dry, and chroma of 2 moist and 2 or 3 dry. It is gravelly loam in the upper part and gravelly loam, very cobbly loam, or gravelly, cobbly, or very cobbly silt loam in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 3 or 4 moist and 4 or 5 dry, and chroma of 2 through 4 moist and dry. It is very cobbly loam, very cobbly heavy silt loam, or very gravelly fine sandy loam.

Canburn series

The Canburn series consists of very deep, poorly drained soils that formed in mixed alluvium weathered from quartzite, sandstone, and limestone. Canburn soils are on nearly level flood plains and valley bottoms at elevations of 4,820 to 6,200 feet. Slopes are 0 to 1 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 45 degrees F.

Canburn soils are near Crooked Creek, Eastcan, Phoebe, Pringle, Redola, and Sunset soils. Crooked Creek soils have more than 35 percent clay in the layer between depths of 10 and 40 inches. Eastcan soils are moderately well drained and have mottles below a depth of 20 inches, and the mean annual soil temperature is more than 47 degrees F. Phoebe soils lack a high water table, have less than 18 percent clay in the layer between depths of 10 and 40 inches, and have a mollic epipedon less than 20 inches thick. Pringle soils have a mollic epipedon less than 20 inches thick, have less than 18 percent clay, and have 50 to 70 percent rock fragments in the layer between depths of 10 and 40 inches. Redola soils lack the characteristic wetness of Canburn soils, have less than 18 percent clay in the layer between depths of 10 and 40 inches, and have mean annual soil temperature of more than 47 degrees F. Sunset soils have less than 18 percent clay in the layer between depths of 10 and 40 inches.

Typical pedon of Canburn silt loam about 1/2 mile north and 1/4 mile west of Porterville Church, 1,000 feet west and 500 feet north of southeast corner section 14, T. 3 N., R. 2 E.:

A11—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; strong medium granular structure; slightly hard, firm, slightly sticky and plastic; many fine and medium roots; moderately calcareous; moderately alkaline (pH 8.2); clear wavy boundary. (6 to 11 inches thick)

A12—8 to 21 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine prominent yellowish red (5YR 4/6) mottles; strong medium granular structure; slightly hard, firm, slightly sticky and plastic; many medium and fine roots; moderately calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary. (9 to 31 inches thick)

C—21 to 48 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 5/4) dry; few fine distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; moderately calcareous; moderately alkaline (pH 8.2); abrupt wavy boundary.

A1b—48 to 60 inches; black (10YR 2/1) silt loam, dark brown (10YR 4/2) dry; few fine faint brown (10YR 4/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; mildly alkaline (pH 7.8).

The mollic epipedon is 24 to more than 60 inches thick. The layer between depths of 10 and 40 inches is dominantly silt loam or loam with strata of very fine sandy loam to clay loam in some pedons. It is an average of 18 to 27 percent clay. The mollic epipedon has chroma of 1 or

2 when moist; where chroma is 2 when moist, distinct or prominent mottles are in the lower part of the mollic epipedon. The soil is 0 to 20 percent gravel. Reaction is mildly alkaline through strongly alkaline in the A1 horizon and mildly alkaline to moderately alkaline in the C horizon. The soil is slightly calacreous to strongly calcareous in the A1 horizon and noncalcareous to strongly calcareous in the C and A1b horizons.

The A1 horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 1 through 3 dry and 1 or 2 moist. It is silt loam, loam, or clay loam. The lower A1 horizon has distinct or prominent mottles with hue of 5YR or 7.5YR and chroma of 4 through 6. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 through 6 dry and 2 through 5 moist, and chroma of 1 through 8 dry and 1 through 4 moist. It is dominantly loam or silt loam with strata of very fine sandy loam, fine sandy loam, loamy fine sand, or clay loam. Mottles are faint to prominent with hue of 5YR through 5Y and chroma of 4 through 8.

Causey series

The Causey series consists of deep and very deep, well drained soils that formed in material weathered from tuffaceous sandstone, siltstone, and tuffaceous limestone. Causey soils are on very steep foothills at elevations of 5,200 to 6,500 feet. They have slopes of 30 to 60 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 44 degrees F.

Causey soils are near Choptie, Hawkins, and Ostler soils. Choptie soils have bedrock at a depth of 14 to 20 inches. Hawkins and Ostler soils have more than 35 percent clay in the layer between depths of 10 and 40 inches.

Typical pedon of Causey silt loam in an area of Causey-Choptie silt loams, 30 to 60 percent slopes, about 1 1/2 miles south of Huntsville, 2,000 feet east and 500 feet south of the northwest corner of section 30, T. 6 N., R. 2 E.:

A11—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; few medium and coarse pores; slightly acid (pH 6.4); clear smooth boundary. (4 to 8 inches thick)

A12—8 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; few medium and coarse pores; slightly acid (pH 6.4); clear smooth boundary. (4 to 8 inches thick)

A13—12 to 19 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium or coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; moderately calcareous; mildly alkaline (pH 7.4); clear wavy boundary. (0 to 7 inches thick)

C1ca—19 to 40 inches; dark grayish brown (2.5Y 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine roots; 15 percent gravel; strongly calcareous; mildly alkaline (pH 7.6); gradual wavy boundary. (8 to 21 inches thick)

C2ca—40 to 54 inches; pale brown (10YR 6/3) gravelly loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; 40 percent gravel; strongly calcareous; mildly alkaline (pH 6.6); abrupt wavy boundary. (0 to 14 inches thick)

C3—54 to 63 inches; pale brown (10YR 6/3) very gravelly loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; 75 percent gravel; strongly calcareous; mildly alkaline (pH 7.6).

The soil is 48 to more than 60 inches deep to bedrock. The mollic epipedon is 11 to 19 inches thick. Depth to the Cca horizon is 8 to 19 inches. Rock fragments are tuffaceous sandstone, siltstone, and limestone and make up 15 to 65 percent of the Cca horizon and 20 to 75 percent of the C horizon. The layer between depths of 10 and 40 inches is loam, silt loam, or gravelly loam with 0 to 30 percent gravel.

The A1 horizon has hue of 10YR or 2.5Y, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 dry and 1 or 2 moist. Reaction is slightly acid or neutral. The Cca horizon has hue of 10YR or 2.5Y, value of 6 or 7 dry and 4 through 6 moist, and chroma of 2 dry and 2 or 3 moist. It is loam, silt loam, or very gravelly loam. The Cca horizon is moderately to strongly calcareous. The C horizon has hue of 10YR, value of 7 dry and 5 or 6 moist, and chroma of 2 dry and 3 moist. It is very gravelly loam, gravelly fine sandy loam, silt loam, or loam with 20 to 70 percent gravel.

Charcol series

The Charcol series consists of very deep, well drained soils that formed in material weathered from quartzite and sandstone conglomerate. Charcol soils are on very steep mountainsides at elevations of 7,000 to 8,500 feet. They have slopes of 30 to 50 percent. Average annual precipitation is about 30 inches, and the mean annual air temperature is about 41 degrees F.

Charcol soils are similar to Flygare soils. They are near Lucky Star, Condie, St. Marys, Ercan, and Moweba soils. Flygare soils have hue of 10YR, 7.5YR, or 5YR in the B2t horizon. Lucky Star soils have a mollic epipedon less than 20 inches thick. Condie soils lack a mollic epipedon. St. Marys and Moweba soils lack a B2t horizon. Ercan soils have a mollic epipedon less than 20 inches thick and have less than 20 percent rock fragments in the B2t horizon.

Typical pedon of Charcol gravelly fine sandy loam in an area of Charcol gravelly fine sandy loam, 30 to 50 percent slopes, about 10 miles north and 1 mile east of Lost Creek Dam, 1,400 feet east and 400 feet south of the west quarter-corner of section 22, T. 7 N., R. 5 E.:

A11—0 to 13 inches; very dark grayish brown (10YR 3/2) gravelly fine

sandy loam, brown (7.5YR 4/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; 40 percent gravel; slightly acid (pH 6.4); clear wavy boundary. (6 to 18 inches thick)

A12—13 to 21 inches; dark brown (7.5YR 3/3) gravelly fine sandy loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; 35 percent gravel, 10 percent cobbles; slightly acid (pH 6.3); gradual irregular boundary. (6 to 18 inches thick)

A21—21 to 30 inches; dark red (2.5YR 3/6) very gravelly sandy loam, light reddish brown (5YR 6/4) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium roots; 10 percent cobbles, 50 percent gravel; slightly acid (pH 6.3); gradual wavy boundary. (8 to 18 inches thick)

A22—30 to 38 inches; dark red (2.5YR 3/6); very gravelly loamy fine sand, light reddish brown (2.5YR 6/4) dry; single grained; loose, nonsticky and nonplastic; few fine and medium roots; 10 percent cobbles, 55 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (0 to 20 inches thick)

A&B—38 to 44 inches; about 60 percent A2 as described in A22 above and 40 percent B2t as described in B2t below; gradual smooth boundary. (0 to 22 inches thick)

B2t—44 to 54 inches; dark red (10R 3/6) gravelly loam, red (2.5YR 4/6) dry; moderate medium subangular blocky structure; very hard, firm, sticky and slightly plastic; few fine and medium roots; common fine and very fine pores; many thin clay films on peds; 35 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary. (8 to 25 inches thick)

C—54 to 62 inches; dark red (2.5YR 3/6) very gravelly sandy loam, red (2.5YR 5/6) dry; single grained; loose, nonsticky and nonplastic; few fine roots; 55 percent gravel; slightly acid (pH 6.2).

The mollic epipedon is 20 to 34 inches thick. The combined thickness of the A1, A2, and B2t horizons ranges from 48 to 60 inches or more. Rock fragments consist of rounded quartzite or sandstone gravel and cobbles; they make up 20 to 50 percent of the A1 horizon, 45 to 70 percent of the A2 horizon, and 35 to 70 percent of the B2t horizon. Reaction is medium acid through neutral in the A1 horizon and slightly acid or medium acid in the A2 and B2t horizons.

The A1 horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is gravelly fine sandy loam, loam, and gravelly, cobbly, or very cobbly loam. The A2 horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 5 through 7 dry and 3 through 5 moist, and chroma of 3 through 6 dry and 4 through 6 moist. It is very gravelly, gravelly, cobbly or very cobbly sandy loam or loam and very cobbly loamy fine sand. The B2t horizon has a dominant hue of 2.5YR or 10R, but in some parts is 5YR. Value is 4 though 6 dry and 3 through 5 moist, and chroma is 4 through 8 dry and 4 through 6 moist. Texture is gravelly loam, gravelly, cobbly, very gravelly, or very cobbly clay loam, gravelly sandy loam, or gravelly, very gravelly, or very cobbly sandy clay loam.

Choptie series

The Choptie series consists of shallow, well drained soils that formed in material weathered mostly from tuffaceous sandstone and tuffaceous siltstone. Choptie soils are on slightly convex side slopes and ridges. Slopes are very steep, face south and west, and range from 30 to 60 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

The Choptie soils are near Bertag, Causey, Hawkins, and Ostler soils. All of these soils are more than 40 inches deep over bedrock. Bertag, Hawkins, and Ostler soils have more than 35 percent clay in the B2 or B2t horizon. Causey soils have a layer of lime accumulation at a depth of about 19 inches.

Typical pedon of Choptie silt loam in an area of Causey-Choptie silt loams, 30 to 60 percent slopes, about 1 mile south of Pineview Reservoir, 2,000 feet west and 500 feet north of the southeast corner of section 24, T. 6 N., R. 1 E.:

A11—0 to 4 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak coarse subangular blocky structure parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; slightly acid (pH 6.4); abrupt smooth boundary. (4 to 7 inches thick)

A12—4 to 8 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and fine and few medium roots; few very fine and fine pores; slightly acid (pH 6.4); clear wavy boundary. (4 to 9 inches thick)

B2—8 to 14 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak medium to coarse subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine and fine roots; common very fine and fine pores; slightly acid (pH 6.4); abrupt irregular boundary. (2 to 6 inches thick)

R—14 inches; tuffaceous sandstone.

The mollic epipedon is 12 to 18 inches thick. Bedrock is at a depth of 14 to 20 inches. Rock fragments consist of gravel and cobbles and generally make up 0 to 10 percent of the profile; soft gravel makes up as much as 30 percent of the B2 horizon in some pedons. Reaction is slightly acid.

The A1 horizon has hue of 10YR, value of 4 dry and 2 or 3 moist, and chroma of 1 or 2. The B2 horizon has hue of 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 or 3 dry and 1 through 3 moist. It is silt loam or fine sandy loam.

Cloud Rim series

The Cloud Rim series consists of very deep, well drained soils formed in material weathered from gneiss, schist, and argillite. Cloud Rim soils are on very steep, north- and west-facing mountainsides at elevations of 5,600 to 6,900 feet. Slopes are 30 to 60 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 42 degrees F.

Cloud Rim soils are similar to Isbell soils. They are near Durfee, Durst, Smarts, and Yeates Hollow soils. Isbell soils have a combined thickness of the A1 and B2t horizons of less than 50 inches. Durfee and Yeates Hollow soils have more than 35 percent clay and more than 35 percent rock fragments in the B2t horizon. Durst soils have more than 35 percent rock fragments in the B2t horizon. Smarts soils lack a B2t horizon and have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches and have a mollic epipedon more than 20 inches thick.

A typical pedon of Cloud Rim loam in an area of Cloud Rim loam, 30 to 60 percent slopes, about 4 miles north and 1 mile west of Morgan County Courthouse at a point 1,600 feet east and 1,000 feet south of the northeast corner of section 11, T. 4 N., R. 2 E.:

A11—0 to 4 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; common fine and medium roots; common micro pores; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (3 to 7 inches thick)

A12—4 to 15 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; common micro pores; 10 percent gravel, 5 to 10 percent cobbles; slightly acid (pH 6.4); gradual irregular boundary. (8 to 13 inches thick)

B21t—15 to 22 inches; dark yellowish brown (10YR 4/4) light clay loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; many very fine, fine, and medium pores; few thin clay films on peds; 15 percent gravel; medium acid (pH 5.8); gradual wavy boundary. (5 to 13 inches thick)

B22t—22 to 34 inches; brown (7.5YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; very hard, firm, very sticky and plastic; few fine and medium roots; many very fine pores; common thin clay films on peds; 10 percent gravel; medium acid (pH 5.8); gradual wavy boundary. (5 to 14 inches thick)

B23t—34 to 56 inches; brown (7.5YR 4/4) clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine pores; common thin clay films on peds; 10 percent gravel; medium acid (pH 5.8); gradual wavy boundary. (6 to 30 inches thick)

C—56 to 66 inches; brown (7.5YR 4/4) cobbly loam, pale brown (10YR 6/3) dry; massive; hard, friable, slightly sticky and nonplastic; 20 percent cobbles, 10 percent gravel; medium acid (pH 5.8).

The mollic epipedon is 12 to 16 inches thick. The combined thickness of the A1 and B2t horizons is 50 to 60 inches or more. Rock fragments are gravel and cobbles; they make up 0 to 20 percent of the A1 and B2t horizons and 10 to 60 percent of the C horizon. Reaction is slightly acid or medium acid in the A1 horizon and medium acid in the B2t and C horizons.

The A1 horizon has hue of 10YR, value of 2 or 3 moist and 4 through 5 dry, and chroma of 2 or 3 dry and moist. The B2t horizon has hue of 7.5YR or 10YR, value of 3 through 5 moist and 5 or 6 dry, and chroma of 2 through 6 moist and 3 through 6 dry. It is clay loam or sandy clay loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 moist and 6 dry, chroma of 2 through 4 moist and 3 or 4 dry. It is silt loam, cobbly or gravelly loam, or very gravelly sandy loam.

Collinston series

The Collinston series consists of very deep, well drained soils formed in material weathered from tuffaceous sandstone and tuffaceous siltstone. Collinston soils occur dominantly on south- and west-facing, convex ridges and knolls of rolling hills and foothills. The elevation is 5,000 to 5,250 feet and the slopes are 15 to 30 percent. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 45 degrees F.

Collinston soils are similar to Stoda soils. They are near Causey, Hawkins, and Manila soils. Stoda and Causey soils have more than 15 percent fine or coarser sand in the layer between depths of 10 and 40 inches. Causey soils are noncalcareous in the upper 8 inches of the A1 horizon. Hawkins soils have more than 35 percent clay in the layer between depths of 10 and 40 inches and have cracks to the surface in late summer. Manila soils have a B2t horizon that is more than 35 percent clay.

Typical pedon of Collinston silt loam in an area of Hawkins-Collinston complex, 6 to 30 percent slopes, in Weber County, about 1.5 miles south of Huntsville Post Office, 2,000 feet east and 2,200 feet north of the southwest corner of section 19, T. 6 N., R. 2 E.:

Ap—0 to 9 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (2.5Y 5/2) dry; weak medium and coarse subangular blocky structure parting to weak very fine and fine granular structure; slightly hard, friable, sticky and slightly plastic; common very fine roots; strongly calcareous; moderately alkaline (pH 8.4); clear smooth boundary. (7 to 10 inches thick)

C1ca—9 to 22 inches; pale olive (5Y 6/3) silty clay loam, pale yellow (5Y 7/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine and few medium pores; strongly calcareous; strongly alkaline (pH 8.8); clear wavy boundary. (10 to 14 inches thick)

C2ca—22 to 36 inches; light gray (5Y 7/2) silt loam, white (5Y 8/2) dry; massive; slightly hard, friable, sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; veins of lime; strongly alkaline (pH 8.8); clear smooth boundary. (12 to 16 inches thick)

C3ca—36 to 60 inches; pale olive (5Y 6/3) silt loam, pale yellow (5Y 8/3) dry; massive; slightly hard, friable, sticky and slightly plastic; few very fine roots; common very fine pores; strongly calcareous; veins and flakes of lime; strongly alkaline (pH 8.6).

The mollic epipedon is 9 to 10 inches thick. Depth to the Cca horizon is 9 to 10 inches. Reaction is moderately alkaline in the A1 horizon and strongly alkaline in the Cca and C horizons. The soil is strongly calcareous throughout.

The Cca and C horizons are silt loam or silty clay loam. The layer between depths of 10 and 40 inches is silt loam or silty clay loam with 18 to 35 percent clay and less than 15 percent fine or coarser sand.

Condie series

The Condie series consists of very deep, well drained soils formed in material weathered from quartzite and sandstone conglomerate. Condie soils are on very steep, north-facing high mountainsides at elevations of 6,800 to 8,100 feet. They have slopes of 30 to 60 percent. The average annual precipitation is about 35 inches, and the mean annual air temperature is about 41 degrees F.

Condie soils are near Charcol, Cristo, Ercan, Geertsen, Lucky Star, Wallsburg, and Yeljack soils. All of these soils have a thicker dark colored surface layer (mollic epipedon). Cristo, Geertsen, and Wallsburg soils lack an A2 horizon. Ercan and Yeljack soils have less than 35 percent rock fragments in the B2t horizon.

Typical pedon of Condie gravelly loam in an area of Condie gravelly loam, 30 to 60 percent slopes, about 10 1/2 miles north of Lost Creek Dam, about 2,200 feet north and 800 feet west of the sotheast corner of section 17, T. 7 N., R. 5 E.:

O1—1 inch to 0; decaying needles, twigs, etc.

A1—0 to 8 inches; dark yellowish brown (10YR 3/4) gravelly loam, brown (7.5YR 5/4) dry; weak medium and coarse subangular blocky structure parting to moderate fine granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine and few medium and coarse roots; common fine pores; 20 percent gravel; slightly acid (pH 6.4); clear wavy boundary. (4 to 9 inches thick)

A2—8 to 25 inches; reddish brown (5YR 4/4) gravelly fine sandy loam, light brown (7.5YR 6/4) dry; moderate, medium and coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; common fine pores; 25 percent gravel; slightly acid (pH 6.4); gradual wavy boundary. (15 to 35 inches thick)

A&B—25 to 32 inches; about 50 percent A2 horizon material as described in the A2 horizon above, and 50 percent B2t materials as described in the B2t horizon following. (0 to 17 inches thick)

B2t—32 to 42 inches; dark red (2.5YR 3/6) gravelly clay loam, red (2.5YR 4/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; common fine and very fine pores; common thin clay films; 35 percent gravel, 5 percent cobbles; slightly acid (pH 6.4); gradual wavy boundary. (10 to 26 inches thick)

C—42 to 66 inches; red (2.5YR 4/6) very gravelly loam, red (2.5YR 5/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 80 percent gravel; moderately calcareous; neutral (pH 7.2). (0 to 26 inches thick)

The combined thickness of the A1, A2, and B2t horizons ranges from 42 to more than 60 inches. Rock fragments consist of rounded quartzite and sandstone gravel and cobbles; they make up 20 to 40 percent of the A1 horizon, 20 to 70 percent of the A2 horizon, 35 to 70 percent of the B2t horizon, and 55 to 80 percent of the C horizon. Reaction is slightly acid or neutral in the A1 horizon, and medium acid to slightly acid in the B2t horizon. The C horizon is moderately calcareous.

The A1 horizon has hue of 10YR through 5YR, value of 4 through 6 dry and 2 or 3 moist, and chroma of 2 through 5 dry and 2 through 4 moist. It is gravelly loam in the upper part and gravelly or cobbly loam in the lower part. The A2 horizon has hue of 7.5YR through 2.5YR, value of 5 through 7 dry and 3 through 5 moist, and chroma of 3 through 6 dry and moist. It is gravelly, very gravelly, or cobbly fine sandy loam and very gravelly, cobbly, or very cobbly sandy loam. The B2t horizon has hue of 5YR through 10R, value of 3 through 6 dry and 3 or 4 moist, and chroma of 6 through 8 dry and 4 through 6 moist. It is gravelly, very gravelly, or cobbly clay loam or gravelly, very gravelly, or cobbly sandy clay loam. The C horizon is very gravelly loam or very gravelly sandy loam.

Cristo series

The Cristo series consists of moderately deep, well drained soils that formed in materials weathered from limestone and shale. Cristo soils are on all aspects on very steep mountainsides at elevations of 7,000 to 7,800 feet. Slopes range from 40 to 60 percent. Average annual precipitation is about 22 inches, and mean annual air temperature is about 42 degrees F.

Cristo soils are similar to Broadhead and Henefer soils. They are near Charcol, Condie, Geertsen, Lucky Star, and Wallsburg soils. All of these soils except Wallsburg soils are more than 40 inches deep to bedrock. Wallsburg soils are less than 20 inches deep to bedrock. Henefer soils have hue of 2.5YR or 5YR and are 20 to 35 percent rock fragments in the B2t horizon. Charcol, Condie, and Lucky Star soils have an A2 horizon. Charcol, Condie, Lucky Star, and Geertsen soils are more than 35 percent rock fragments and less than 35 percent clay in the B2t horizon.

Typical pedon of Cristo loam in an area of Cristo-Wallsburg complex, 40 to 60 percent slopes, about 10 1/4 miles north and 1 mile east of Lost Creek Dam, about 375 feet east and 100 feet south of the northwest corner of section 23, T. 7 N., R. 5 E.:

O1—2 inches to 0; organic mat, leaves, stems, etc.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine and medium granular structure; slightly hard, friable, slightly sticky and plastic; many fine and very fine and few medium roots; 5 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary. (4 to 6 inches thick)

A12—5 to 13 inches; very dark grayish brown (10YR 3/2) heavy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure that parts to weak fine and medium granular; hard, friable, slightly sticky and plastic; common fine and very fine and few medium and coarse roots; 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary. (4 to 8 inches thick)

B2t—13 to 21 inches; dark brown (10YR 3/2) gravelly heavy silty clay loam, grayish brown (10YR 5/3) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and very plastic; common very fine and fine and few medium and coarse roots; common very fine and few fine pores; many moderately thick clay films on peds; 25 percent gravel; slightly acid (pH 6.3); abrupt smooth boundary. (8 to 13 inches thick)

C—21 to 35 inches; dark brown (10YR 3/3) very gravelly heavy silty clay loam (pockets of silty clay loam adhering to soft shale fragments), grayish brown (10YR 5/2) dry; ped size and shape determined by space available between soft shale fragments, but dominantly weak medium subangular blocky structure; very hard, very firm, sticky and very plastic; few very fine and medium roots; many moderately thick clay films on peds; 85 percent soft shale fragments; moderately calcareous; mildly alkaline (pH 7.4).

R—35 to 60 inches; fractured shale.

The mollic epipedon is 21 to 35 inches thick. The combined thickness of the A1 and B2t horizons is 21 to 35 inches. Depth to bedrock ranges from 29 to 35 inches. Rock fragments consist of angular limestone and shale; they make up 0 to 10 percent of the A1 horizon, 0 to 25 percent of the B2t horizon, and 55 to 95 percent of the C horizon.

The A1 horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. The B2t horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 3 moist. It is gravelly heavy silty clay loam or heavy clay loam. The C horizon has hue of 10YR, value of 5 dry and 3 or 4 moist, and chroma of 2 dry and 2 or 3 moist. It is very gravelly heavy silty clay loam or very gravelly heavy clay loam. The C horizon ranges from slightly acid through mildly alkaline, and is slightly to moderately calcareous.

Crooked Creek series

The Crooked Creek series consists of very deep, poorly drained soils that formed in alluvium weathered from sandstone, quartzite, and limestone. Crooked Creek soils are on flood plains and valley bottoms at elevations of

4,880 to 5,050 feet. Slopes are 0 to 1 percent and are long. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

Crooked Creek soils are similar to Canburn soils. They are near Brownlee, Canburn, Eastcan, Manila, Phoebe, and Utaba soils. Canburn soils have 18 to 35 percent clay in the layer between depths of 10 to 40 inches. Brownlee soils are well drained and have a B2t horizon that is 18 to 35 percent clay. Eastcan soils are moderately well drained and have a B2t horizon that is 18 to 35 percent clay. Manila soils are well drained, have a mollic epipedon that is 10 to 20 inches thick, and a B2t horizon. Phoebe soils are well drained and are less than 18 percent clay in the layer between depths of 10 and 40 inches. Utaba soils are well drained and have 40 to 75 percent rock fragments, and less than 18 percent clay in the layer between depths of 10 to 40 inches.

Typical pedon of Crooked Creek silty clay loam (fig. 3) in Weber County, 1 1/2 miles northeast of Huntsville Post Office, 2,400 feet west and 250 feet north of the east quarter-corner of section 8, T. 6 N., R. 2 E.:

O2—3 inches to 0; decaying organic matter. (0 to 5 inches thick)

A11—0 to 7 inches; very dark brown (10YR 2/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) dry; common fine prominent yellowish red (5YR 4/6) mottles; weak fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine and fine and few medium roots; few very fine and fine pores; slightly acid (pH 6.2); clear smooth boundary. (7 to 13 inches thick)

A12—7 to 14 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; common fine prominent yellowish red (5YR 4/8) mottles; moderate fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and fine pores; slightly acid (pH 6.1); gradual wavy boundary. (0 to 9 inches thick)

C1—14 to 21 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; common fine distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine and fine roots; common very fine and few fine pores; slightly acid (pH 6.1); clear smooth boundary. (7 to 11 inches thick)

C2—21 to 42 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine roots; few very fine and fine pores; slightly acid (pH 6.1); gradual wavy boundary. (7 to 21 inches thick)

C3—42 to 52 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; common fine distinct yellowish brown (10YR 5/4) mottles; massive; very hard, friable, slightly sticky and plastic; slightly acid (pH 6.2); gradual wavy boundary. (6 to 10 inches thick)

C4—52 to 56 inches; dark grayish brown (10YR 4/2) sandy loam, brown (10YR 5/3) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; hard, very friable, nonsticky and nonplastic; neutral (pH 6.8); clear smooth boundary. (4 to 12 inches thick)

C5—56 to 63 inches; brown (10YR 5/3) sandy loam, light yellowish brown (10YR 6/4) dry; common medium faint yellowish brown (10YR 5/4) mottles; massive; hard, very friable, nonsticky and slightly plastic; slightly acid (pH 6.2). (0 to 7 inches thick)

The mollic epipedon is 21 to 50 inches thick. Depth to the seasonal high water table is 0 to 20 inches. Reaction is slightly acid to mildly alkaline in the A1 horizon and slightly acid to moderately alkaline in the C horizons.

The A1 horizon has hue of 10YR, value of 3 or 4 dry and 2 moist, and chroma of 1 or 2 dry and moist. Where chroma is 2 there are common fine prominent yellowish red (5YR 4/6 or 4/8) mottles. The A1 horizon is silty clay loam or clay loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 through 6 dry and 3 through 5 moist, and chroma of 1 through 4 dry and moist. Mottles are few to many, fine to medium, and distinct or prominent. It is silty clay, clay, or clay loam or is silty clay stratified with sandy loam or fine sandy loam in the lower part.

Croydon series

The Croydon series consists of deep and very deep, well drained soils formed in materials weathered from sandstone. Croydon soils are on north-facing, very steep high mountainsides at elevations of 6,400 to 8,300 feet. They have slopes of 30 to 60 percent. Average annual precipitation is about 30 inches, and mean annual air temperature is about 40 degrees F.

Croydon soils are near Isbell, Kilfoil, Lucky Star, Scave, and Hades soils. Isbell soils lack an A2 horizon and are slightly warmer in summer. Kilfoil soils lack a mollic epipedon and are 20 to 40 inches deep to bedrock. Lucky Star and Scave soils have more than 35 percent rock fragments in the B2t horizon and have hue of 7.5YR, 5YR, or 2.5YR. Hades soils have a mollic epipedon more than 20 inches thick and lack an A2 horizon.

Typical pedon of Croydon loam in an area of Croydon loam, 30 to 60 percent slopes, about 8.5 miles east and 4 miles north of Croydon, at a point 1,475 feet south and 200 feet east of the northwest corner of section 34, T. 5 N., R. 5 E.:

O1—1 inch to 0; leaves and other plant material. (1 to 4 inches thick)

A11—0 to 4 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak coarse platy structure parting to moderate fine granular structure; soft, friable, nonsticky and slightly plastic; many very fine, fine, and coarse roots; slightly acid (pH 6.5); clear smooth boundary. (3 to 16 inches thick)

A12—4 to 16 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, very friable, nonsticky and slightly plastic; many very fine through coarse roots; slightly acid (pH 6.5); abrupt broken boundary. (0 to 13 inches thick)

A2—16 to 22 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine through coarse roots; common fine pores; 20 percent gravel; 35 percent animal burrows filled with A12 horizon material; slightly acid (pH 6.4); clear wavy boundary. (3 to 11 inches thick)

B21t—22 to 28 inches; light olive brown (2.5Y 5/4) silty clay loam, pale olive (5Y 6/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; common fine pores; common thin and many moderately thick clay films on peds; small animal burrows filled with A12 material; slightly acid (pH 6.2); clear smooth boundary. (3 to 10 inches thick)

B22t—28 to 40 inches; light olive brown (2.5Y 5/4) silty clay loam, pale olive (5Y 6/3) dry; moderate coarse subangular blocky structure parting to moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common fine pores; continuous thin clay films on peds; slightly acid (pH 6.2); clear smooth boundary. (6 to 31 inches thick)

C—40 to 48 inches; light olive brown (2.5Y 5/4) heavy silt loam, pale olive (5Y 6/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; slightly acid (pH 6.2); abrupt smooth boundary.

R—48 inches; weathered sandstone.

The mollic epipedon is 11 to 19 inches thick. The combined thickness of the A1, A2, and B2t horizons ranges from 39 to 53 inches. Weathered

sandstone occurs at a depth of 45 to more than 60 inches. Rock fragments consist of rounded gravel and cobbles; they make up 0 to 20 percent of the A1 horizon, 0 to 30 percent of the A2 horizon, 0 to 20 percent of the B2t horizon, and 0 to 20 percent of the C horizon. Reaction is slightly acid to medium acid in the A1, A2, and B2t horizons, and medium acid through neutral in the C horizon. The C horizon is noncalcareous to moderately calcareous.

The A1 horizon has hue of 10YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is loam or silt loam. The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 8 dry and 4 through 6 moist, and chroma of 2 through 4 dry and moist. It is loam, cobbly loam, or cobbly sandy loam. The B2t horizon generally has hue of 2.5Y or 5Y but has hue of 10YR in parts of some pedons. Value is 5 through 7 dry and 4 or 5 moist, and chroma is 2 through 4 dry and moist. It is silty clay loam or clay loam. The C horizon has dominant hue of 2.5Y or 5Y, but hue is 10YR in parts of some pedons. Value is 5 through 7 dry and 4 or 5 moist, and chroma is 2 through 4 dry and moist. It is silt loam, loam, gravelly loam, clay loam, or silty clay loam.

Donner series

The Donner series consists of moderately deep, well drained soils formed in material weathered from tuffaceous sandstone and andesite. They are on south- and west-facing, steep mountain footslopes and very steep mountainsides. Slopes are 10 to 50 percent. Elevations are 5,650 to 7,200 feet. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 42 degrees F.

Donner soils are similar to Manila and Ostler soils. They are near Bertag, Croydon, Hawkins, Henefer, Manila, Richville, and Yeates Hollow soils. All of these soils except Richville soils are more than 40 inches deep to bedrock. Ostler soils have hue of 10YR and 2.5Y in the B2t horizon. Bertag and Henefer soils have a mollic epipedon more than 20 inches thick. Croydon soils are on northern exposures under mixed aspen and conifers and have a cooler summer temperature. Hawkins soils lack a B2t horizon and crack to the surface in late summer. Richville soils lack a mollic epipedon and a B2t horizon and have less than 35 percent clay in the layer between depths of 10 and 40 inches. Yeates Hollow soils are more than 35 percent rock fragments in the B2t horizon.

Typical pedon of Donner cobbly loam in an area of Donner cobbly loam, 30 to 50 percent slopes, about 5 1/4 miles south and 1/4 mile east of East Canyon Dam, 1,600 feet west and 2,300 feet north of the southeast corner of section 3, T. 1 N., R. 3 E.:

A11—0 to 2 inches; very dark brown (10YR 2/2) cobbly loam, dark grayish brown (10YR 4/2) dry; weak medium platy structure parting to weak medium granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine and very fine and few medium roots; common fine and few medium pores; 10 percent gravel, 15 percent cobbles; slightly acid (pH 6.2); abrupt smooth boundary. (2 to 10 inches thick)

A12—2 to 6 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak medium granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine and very fine and few medium roots; common fine pores; 10 percent gravel; medium acid (pH 6.0); clear smooth boundary. (0 to 10 inches thick)

B21t—6 to 10 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate coarse granular structure; hard, firm, sticky and plastic; common fine and very fine and few medium roots; common fine pores; 20 percent gravel; slightly acid (pH 6.2); abrupt wavy boundary. (2 to 16 inches thick)

B22t—10 to 15 inches; dark brown (10YR 3/3) heavy clay loam, brown (10YR 4/3) dry; weak coarse prismatic structure parting to moderate coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few very fine and medium roots; few fine pores; common thin and few moderately thick clay films on peds; 5 percent gravel; slightly acid (pH 6.2); clear wavy boundary. (4 to 22 inches thick)

B23t—15 to 34 inches; dark brown (7.5YR 4/3) silty clay, brown (10YR 5/3) dry; weak coarse prismatic structure parting to moderate coarse subangular blocky structure; extremely hard, extremely firm, sticky and plastic; few very fine and medium roots; few fine pores; continuous thin and common moderately thick clay films on peds; 5 percent gravel; medium acid (pH 6.0); abrupt wavy boundary. (0 to 22 inches thick)

Cr—34 to 60 inches; weathered andesite.

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1 and B2t horizons is 23 to 40 inches. Rock fragments consist of gravel and cobbles; they make up 10 to 40 percent of the A1 horizon and 0 to 20 percent of the B2t horizons. Reaction of the soil is medium or slightly acid.

The A1 horizon has hue of 10YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 dry and 2 or 3 moist. It is cobbly loam, loam, or gravelly loam. The B2t horizon has hue of 10YR and 7.5YR, value of 4 through 6 dry and 2 through 4 moist, and chroma of 2 through 4 dry and moist. It is clay loam, silty clay, or clay.

Durfee series

The Durfee series consists of very deep, well drained soils that formed in materials weathered from sandstone and quartzite. Durfee soils are on east-, south-, and west-facing, very steep mountainsides at elevations of 5,200 to 7,500 feet. Slopes are 30 to 70 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 43 degrees F.

Durfee soils are similar to Yeates Hollow soils. They are near Foxol, Moweba, Poleline, Smarts, and Yeates Hollow soils. Yeates Hollow soils have a considerable decrease in clay content within a depth of 60 inches. Foxol soils have bedrock at a depth of less than 20 inches. Moweba soils have a mollic epipedon more than 20 inches thick, lack a B2t horizon, and are less than 35 percent clay in the layer between depths of 10 and 40 inches. Poleline soils lack a B2t horizon. Smarts soils have a mollic epipedon more than 20 inches thick and have less than 35 percent clay in the B2t horizon.

Typical pedon of the Durfee stony loam in an area of Durfee stony loam, 30 to 70 percent slopes (fig. 5) about 1/2 mile east and 3/4 mile north of Patio Springs, 1,320 feet north and 200 feet west of the southeast corner of section 15, T. 7 N ., R. 1 E.:

A11—0 to 6 inches; dark brown (10YR 3/3) stony loam, brown (10YR 5/3) dry; weak medium and coarse subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; 30 to 40 percent of the surface is covered by stones, cobbles, and gravel; 5 percent stones, 30 percent cobbles, and 25 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (4 to 10 inches thick)

A12—6 to 12 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable, sticky and plastic; common very fine and fine and few medium

and coarse roots; 5 percent stones, 20 percent cobbles, and 45 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (0 to 11 inches thick)

B1—12 to 16 inches; reddish brown (5YR 4/4) very gravelly loam, brown (7.5YR 5/4) dry; moderate medium and fine subangular blocky structure; extremely hard, firm, sticky and plastic; common fine and very fine and few medium and coarse roots; many very fine and fine pores; 10 percent stones, 20 percent cobbles, and 50 percent gravel; slightly acid (pH 6.1); clear irregular boundary. (0 to 9 inches thick)

B21t—16 to 25 inches; dark reddish brown (2.5YR 3/4) very gravelly heavy clay loam, reddish brown (5YR 4/4) dry; moderate medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine, medium, and coarse roots; few very fine pores; common thin clay films on peds; 40 percent gravel, 20 percent cobbles, 10 percent stones; slightly acid (pH 6.1); gradual smooth boundary. (5 to 13 inches thick)

B22t—25 to 37 inches; yellowish red (5YR 4/6) very gravelly clay, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; few very fine pores; common thin clay films on peds; 10 percent stones, 25 percent cobbles, and 40 percent gravel; slightly acid (pH 6.1); gradual smooth boundary. (12 to 25 inches thick)

B23t—37 to 50 inches; red (2.5YR 4/6) very gravelly clay, red (2.5YR 4/6) dry; moderate medium prismatic structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; few very fine pores; many thin clay films on peds; 10 percent stones, 30 percent gravel, 25 percent cobbles; slightly acid (pH 6.1); gradual irregular boundary. (6 to 13 inches thick)

B3t—50 to 60 inches; dark red (2.5YR 3/6) very gravelly clay, dark red (2.5YR 3/6) dry; moderate medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; 5 percent stones, 15 percent cobbles, 55 percent gravel; slightly acid (pH 6.1).

The mollic epipedon is 10 to 20 inches thick. The combined thickness of the A1, B1, and B2t horizons is 60 inches or more. Clay content of the B2t horizon does not decrease by as much as 20 percent of the maximum within 60 inches of the surface. Rock fragments are rounded sandstone and quartzite gravel, cobbles, and stones; they make up 20 to 65 percent of the A1 horizon, 40 to 85 percent of the B1 horizon, and 55 to 70 percent of the B2t horizon. Reaction is slightly acid to neutral in the A1 horizon and medium acid to neutral in the B1 and B2t horizons.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is stony loam in the upper part and is very gravelly, gravelly, cobbly, or very cobbly loam, cobbly clay loam, or very cobbly sandy clay loam in the lower part. The B1 horizon has hue of 10YR through 5YR, value of 5 dry and 3 and 4 moist, and chroma of 3 or 4 dry and 2 through 6 moist. It is very gravelly loam or gravelly, very gravelly, cobbly, or very cobbly clay loam. The B2t horizon has hue of 7.5YR through 2.5YR, value of 3 through 6 dry and 3 through 5 moist, and chroma of 4 through 8 dry and 3 through 8 moist. It is very gravelly or very cobbly heavy clay loam, very gravelly, gravelly, cobbly, or very cobbly clay, very gravelly or very cobbly sandy clay, or very cobbly silty clay.

Durst series

The Durst series consists of moderately deep, well drained soils that formed in materials weathered from quartzite. Durst soils are on south- and west-facing, very steep mountainsides at elevations of 6,000 to 7,700 feet. The slopes range from 40 to 70 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 41 degrees F.

Durst soils are similar to Hoskin soils and are near Agassiz, Broad Canyon, Burgi, Geertsen, Lucky Star, and Smarts soils. Hoskin soils have base saturation of more than 75 percent in all parts above a depth of 30 inches and have hue of 7.5YR, 5YR, or 2.5YR in the B2t horizon. Agassiz soils are less than 20 inches deep to bedrock. Broad Canyon soils are more than 40 inches deep to bedrock, lack a B2t horizon, and have cooler summer temperatures. Burgi and Smarts soils are more than 40 inches deep over bedrock and have a mollic epipedon more than 20 inches thick. Burgi soils lack a B2t horizon. Geertsen and Lucky Star soils are more than 40 inches deep to bedrock and have cooler summer temperatures.

Typical pedon of Durst gravelly loam, in an area of Durst gravelly loam, 40 to 70 percent slopes, about 6 miles north and 1 mile west of the Morgan County Courthouse, 1,200 feet west and 700 feet north of the southeast corner of section 35, T. 5 N., R. 2 E.:

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; 40 percent angular gravel; medium acid (pH 5.8); clear smooth boundary. (2 to 4 inches thick)

A12—4 to 10 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; few fine pores; 25 percent angular gravel, 20 percent angular cobbles; medium acid (pH 5.8); clear smooth boundary. (6 to 16 inches thick)

B21t—10 to 21 inches; dark brown (7.5YR 4/4) gravelly clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine through medium roots; common fine pores; few thin clay films on peds; 30 percent angular gravel, 15 percent angular cobbles; medium acid (pH 5.6); gradual wavy boundary. (4 to 11 inches thick)

B22t—21 to 25 inches; dark brown (7.5YR 4/4) gravelly clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few very fine pores; few thin clay films on peds; 45 percent angular gravel; strongly acid (pH 5.4); abrupt smooth boundary. (0 to 6 inches thick)

R—25 inches; fractured quartzite.

The mollic epipedon is 10 to 20 inches thick. The combined thickness of the A1 and B2t horizons is 20 to 32 inches over quartzite. Rock fragments consist of angular quartzite gravel and cobbles; they make up 25 to 45 percent of the A1 horizon and 45 to 80 percent of the B2t horizon. Reaction is medium to strongly acid.

The A1 horizon has hue of 10YR and 7.5YR, value of 2 or 3 moist and 4 or 5 dry, and chroma of 2 or 3 moist and 2 through 4 dry. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5 moist and 5 dry, and chroma of 2 through 4 moist and 4 through 6 dry. It is gravelly or very gravelly clay loam or very cobbly loam.

Eastcan series

The Eastcan series consists of very deep, moderately well drained soils that formed in alluvium weathered from sandstone, quartzite, and limestone. Eastcan soils are on flood plains, stream terraces, and valley bottoms at elevations of 4,830 to 5,200 feet. Slopes are 0 to 3 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 45 degrees F.

Eastcan soils are near Canburn, Crooked Creek, Nebeker, Redola, and Sunset soils. Canburn and Crooked Creek soils have mottles with a chroma less than 2 above a depth of 20 inches. Crooked Creek soils are silty clay or

heavy clay loam between depths of 10 and 40 inches. Nebeker soils have a B2t horizon. Redola soils lack mottles and average less than 18 percent clay and more than 15 percent sand coarser than very fine sand between depths of 10 and 40 inches. Sunset soils average less than 18 percent clay between depths of 10 and 40 inches.

Typical pedon of Eastcan loam in an area of Eastcan loam, 0 to 3 percent slopes, about 2 miles south of Morgan, about 400 feet east and 1,700 feet north of southwest corner of section 12, T. 3 N., R. 2 E.:

A11—0 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and plastic; common very fine and few fine roots; moderately calcareous; mildly alkaline (pH 7.8); abrupt smooth boundary. (2 to 10 inches thick)

A12—9 to 13 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and few fine roots; few fine pores; moderately calcareous; mildly alkaline (pH 7.8); clear smooth boundary. (4 to 11 inches thick)

A13—13 to 28 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine and fine and few medium and coarse roots; few fine pores; moderately calcareous; mildly alkaline (pH 7.8); clear smooth boundary. (0 to 15 inches thick)

C1—28 to 39 inches; dark yellowish brown (10YR 3/4) silt loam, yellowish brown (10YR 5/4) dry; few fine faint brown (7.5YR 5/4) mottles; massive; slightly hard, friable, slightly sticky and plastic; many very fine and fine and few medium and coarse roots; few fine pores; strongly calcareous; moderately alkaline (pH 8.0); clear smooth boundary. (5 to 12 inches thick)

C2—39 to 60 inches; dark brown (7.5YR 4/2) silt loam, yellowish brown (10YR 5/4) dry; few fine faint brown (7.5YR 5/4) mottles; massive; slightly hard, friable, slightly sticky and plastic; few very fine roots; few fine pores; strongly calcareous; moderately alkaline (pH 8.2).

The mollic epipedon is 21 to 33 inches thick. The organic-matter content decreases irregularly with increasing depth. These soils have a seasonal high water table at a depth of 25 to 50 inches, but it is below a depth of 40 inches most of the time. Mottles are few fine to common medium and faint top rominent with hue of 10YR, 7.5YR, and 5YR, value of 4 or 5, and chroma of 4 through 8. Depth to mottles ranges from 20 to 36 inches. Reaction is mildly through strongly alkaline.

The A horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 and 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam, silt loam, clay loam, or very fine sandy loam. The A1 horizon is slightly or moderately calcareous. It is 21 to 33 inches thick. The C horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 through 7 dry and 3 through 5 moist, and chroma of 2 through 6 dry and moist. It is silt loam, loam, or clay loam with thin layers of fine sandy loam, very fine sandy loam, or silty clay loam. The C horizon is slightly through strongly calcareous.

Eastcan variant

The Eastcan variant consists of very deep, well drained soils formed in alluvium weathered from quartzite, sandstone, and limestone. Eastcan variant soils are on strongly sloping alluvial fans and mountain foot slopes at elevations of 4,900 to 5,800 feet. Slopes range from 6 to 10 percent. Average annual precipitation is about 18 inches, and the mean annual air temperature is about 45 degrees F.

Eastcan variant soils are similar to Eastcan and Redola soils. They are near Isbell, Mondey, Nebeker, Parleys, and Richville soils. Eastcan soils have less than 20 percent rock fragments in the subsoil and have a seasonal high water table at a depth of 25 to 50 inches. Redola soils have less than 18 percent clay in the layer between depths of 10 to 40 inches. Isbell soils have a mollic epipedon less than 20 inches thick and have a B2t horizon. Mondey and Nebeker soils have a B2t horizon containing more than 35 percent clay. Mondey soils crack to the surface in late summer. Parleys soils have a mollic epipedon less than 20 inches thick and have B2t and Cca horizon. Richville soils lack a mollic epipedon, have a Cca horizon, and are calcareous throughout.

Typical pedon of Eastcan variant loam, in an area of Eastcan variant loam, 6 to 10 percent slopes, in Morgan County, approximately 1/2 mile west of Enterprise, 1,400 feet west and 1,700 feet north of the southeast corner of section 5, T. 4 N., R. 2 E.:

A11—0 to 4 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; hard, friable, slightly sticky and plastic; common very fine and fine and few medium roots; 10 percent gravel; mildly alkaline (pH 7.8); slightly calcareous; clear smooth boundary. (3 to 8 inches thick)

A12—4 to 9 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak medium granular structure; hard, friable, slightly sticky and plastic; common very fine and fine and few medium and coarse roots; 20 percent gravel; slightly calcareous; mildly alkaline (pH 7.5); clear smooth boundary. (4 to 9 inches thick)

A13—9 to 16 inches very dark brown (10YR 2/2) gravelly clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular structure; hard, friable, sticky and plastic; common very fine and fine and few medium and coarse roots; 45 percent gravel and cobbles; slightly calcareous; mildly alkaline (pH 7.6); clear smooth boundary. (0 to 8 inches thick)

C1—16 to 28 inches; very dark brown (10YR 2/2) gravelly clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine and few medium and coarse roots; 30 percent gravel and cobbles; slightly calcareous, mildly alkaline (pH 7.5); clear smooth boundary. (11 to 21 inches thick)

C2—28 to 40 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, grayish brown (10YR 5/2) dry; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine and few medium roots; 35 percent gravel and cobbles; slightly calcareous, mildly alkaline (pH 7.6); clear smooth boundary. (11 to 13 inches thick)

C3ca—40 to 60 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; 40 percent gravel, moderately alkaline (pH 8.0); moderately calcareous.

The mollic epipedon is 31 to 40 inches thick. The layer between depths of 10 and 40 inches has 20 to 35 percent rock fragments and 20 to 35 percent clay. Rock fragments are rounded and angular gravel and a few cobbles; they make up 5 to 30 percent of the A1 horizon and 15 to 65 percent of the C horizon. Average content of rock fragments in the C horizon is 20 to 35 percent. Reaction is mildly alkaline to moderately alkaline in the A1 horizon and mildly alkaline to strongly alkaline in the C horizon. This soil is slightly to moderately calcareous in the A1 horizon and moderately to strongly calcareous in the C horizon.

The A1 horizon has hue of 10YR and 7.5YR, value of 4 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam in the

upper part and gravelly loam in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry and 2 through 4 moist, and chroma of 2 through 4 dry and moist. It is gravelly loam, silt loam, clay loam, sandy clay loam, silt loam, or loam.

Ercan series

The Ercan series consists of deep and very deep, well drained soils formed in material weathered from sandstone. Ercan soils are on all aspects on high mountain ridges and mountainsides. Slopes range from 3 to 60 percent, but are dominantly 3 to 30 percent. The elevation is 6,000 to 8,700 feet. Average annual precipitation is about 35 inches, and the mean annual air temperature is about 41 degrees F.

Ercan soils are similar to Flygare and Lucky Star soils. They are near Condie, Herd, and Yeljack soils. Flygare and Lucky Star soils have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Flygare and Yeljack soils have a mollic epipedon more than 20 inches thick. Condie and Herd soils lack a mollic epipedon.

Typical pedon of Ercan loam, in an area of Ercan loam, 3 to 15 percent slopes, about 8 miles northeast of Causey Dam at a point 1,600 feet west and 800 feet south of the northeast corner of section 24, T. 7 N., R. 4 E.:

A11—0 to 5 inches; very dark brown (7.5YR 2/2) loam, dark brown (7.5YR 3/2) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and very fine and few medium and coarse roots; slightly acid (pH 6.4); clear smooth boundary. (5 to 11 inches thick)

A12—5 to 18 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/3) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; many very fine pores; slightly acid (pH 6.4); gradual wavy boundary. (7 to 13 inches thick)

A2—18 to 27 inches; yellowish red (5YR 5/6) fine sandy loam, pink (5YR 7/4) dry; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; many very fine pores; slightly acid (pH 6.4); gradual wavy boundary. (5 to 18 inches thick)

B&A—27 to 35 inches; about 30 percent A2 as described in A2 above; 70 percent B2t as follows: red (2.5YR 4/8) clay loam, light red (2.5YR 6/6) dry; moderate coarse prismatic structure parting to strong medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine and medium roots; common very fine pores; common thin clay films on peds; slightly acid (ph 6.2); gradual wavy boundary. (0 to 8 inches thick)

B2t—35 to 56 inches; red (10R 4/6) clay loam, red (10R 4/6) dry; strong coarse prismatic structure parting to strong medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine and medium roots; many very fine pores; many moderately thick clay films on peds; medium acid (pH 6.0); diffuse irregular boundary. (10 to 21 inches thick)

R—56 to 60 inches; fractured, weathered sandstone with B2t materials in cracks.

The mollic epipedon is 12 to 19 inches thick. The combined thickness of the A1, A2, and B2t horizon ranges from 47 to 60 inches or more over bedrock. Rock fragments consist of rounded gravel and cobbles; they make up 0 to 10 percent of the A1 horizon, 0 to 50 percent of the A2 horizon, and 0 to 20 percent of the B2t horizon. Reaction ranges from slightly acid to medium acid in the A1 and A2 horizons and from medium acid to neutral in the B2t horizon.

The A1 horizon has hue of 10YR through 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. The A2 horizon has hue of 7.5YR through 2.5YR, value of 4 through 7 dry and 3 through 6 moist, and chroma of 4 through 6 dry and moist. It is fine sandy loam, loam, or cobbly clay loam. The B2t horizon has hue of 5YR through 10R, value of 4 through 6 dry and 3 through 5 moist, and chroma of 4 through 6 dry and 4 through 8 moist. It is clay loam, silty clay loam, or sandy clay loam.

Etchen series

The Etchen series consists of moderately deep, well drained soils formed in materials weathered from sandstone, quartzite, and conglomerate. Etchen soils are on dominantly south- and west-facing mountainsides and foot slopes. The slopes are 25 to 70 percent and the elevation is 5,400 to 8,200 feet. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 41 degrees F.

Etchen soils are near Bullnel, Guilder, Henhoit, Lucky Star, Redcan, and Schuster soils. Bullnel soils have less than 35 percent rock fragments in the B2t horizon. Guilder soils have more than 35 percent clay and less than 20 percent rock fragments in the B2t horizon. Henhoit, Lucky Star, and Schuster soils have a mollic epipedon and are more than 40 inches deep to bedrock. Lucky Star and Schuster soils have cooler temperatures in summer. Redcan soils lack a B2t horizon and have shale at a depth of 15 to 20 inches.

Typical pedon of Etchen very cobbly loam, in an area of Etchen very cobbly loam, 25 to 50 percent slopes, about 10 miles north and 3 miles east of Lost Creek Dam, 900 feet east and 1,750 feet south of northwest corner of section 24, T. 7 N., R. 5 E.:

A11—0 to 4 inches; dark reddish brown (5YR 3/3) very cobbly loam, reddish brown (5YR 5/4) dry; weak medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and medium roots; 15 percent cobbles, 15 percent gravel; slightly calcareous; lime disseminated; mildly alkaline (pH 7.8); abrupt smooth boundary. (2 to 8 inches thick)

A12—4 to 8 inches; reddish brown (5YR 4/4) cobbly loam, reddish brown (5YR 5/4) dry; weak medium subangular blocky structure parting to moderate coarse granular structure; soft, friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; 20 percent cobbles and stones and 20 percent gravel; moderately calcareous; lime disseminated; mildly alkaline (pH 7.8); clear wavy boundary. (0 to 10 inches thick)

B21t—8 to 16 inches; yellowish red (5YR 4/6) cobbly sandy clay loam, yellowish red (5YR 5/6) dry; moderate fine and medium subangular blocky structure; very hard, firm, sticky and slightly plastic; common very fine, fine, and medium roots; few fine pores; common thin clay films on peds; 20 percent gravel and 20 percent cobbles and stones; moderately calcareous; lime disseminated; moderately alkaline (pH 8.2); clear wavy boundary. (3 to 12 inches thick)

B22t—16 to 34 inches; yellowish red (5YR 5/6) very cobbly sandy clay loam, yellowish red (5YR 5/6) dry; moderate medium subangular blocky structure; very hard, firm, sticky and slightly plastic; common very fine, fine, and medium roots; few fine pores; common thin clay films on peds; 35 percent cobbles and stones and 25 percent gravel; strongly calcareous; lime disseminated; moderately alkaline (pH 8.2); abrupt irregular boundary. (0 to 19 inches thick)

R—34 inches; fractured sandstone.

The combined thickness of the A1 and B2t horizons is 21 to 40 inches. Approximately 60 percent of the soil surface is covered by cobbles and

gravel. Depth to bedrock is 21 to 40 inches. Rock fragments consist dominantly of angular sandstone and rounded quartzite gravel, cobbles, and stones; they make up 20 to 60 percent of the A1 horizon, 45 to 70 percent of the B2t horizon, and 60 to 80 percent of the C horizon. Reaction of the A1 and B2t horizons is dominantly mildly alkaline to moderately alkaline but in places is slightly acid or neutral.

The A1 horizon has hue of 2.5YR, 5YR, or 7.5YR. Value is 3 moist in the upper 4 to 6 inches and 3 or 4 below, and 3 through 6 dry. Chroma is 2 through 6 moist and 3 through 8 dry. It is very cobbly or cobbly loam or gravelly loam. The A1 horizon is dominantly slightly to moderately calcareous, but is noncalcareous in some pedons. The B2t horizon has a hue of 2.5YR and 5YR, value of 3 through 5 moist and 3 through 6 dry, and chroma of 4 through 3 dry and moist. It is cobbly or very cobbly sandy clay loam; very gravelly, gravelly, or very cobbly clay loam; or very gravelly or very cobbly loam. The C horizon, where present, has hue of 2.5YR or 5YR, value of 3 through 5 moist and 4 through 6 dry, and chroma of 4 through 6 moist and 4 through 8 dry. It is moderately to very strongly calcareous and moderately alkaline.

Flygare series

The Flygare series consists of very deep, well drained soils formed in material weathered from sandstone, quartzite, conglomerate, and some schist. Flygare soils are on north-, east-, or west-facing, very steep, high mountainsides at elevations of 6,500 to 8,500 feet. The slopes are 30 to 60 percent. Average annual precipitation is about 35 inches and the mean annual air temperature is about 42 degrees F.

Flygare soils are similar to Charcol soils. They are near Nagitsy and Poleline soils. Charcol soils have hue of 5YR or redder in the B2t horizon, and the B2t is more than 40 inches deep. Nagisty soils lack A2 and B2t horizons and have bedrock at depths of 20 to 40 inches. Poleline soils lack A2 and B2t horizons.

Typical pedon of Flygare loam, in an area of Flygare loam, 3 to 60 percent slopes, in Morgan County, 2 miles south and 6 miles west of Porterville, about 1,400 feet south and 250 feet east of the north quarter-corner, section 36, T. 3 N., R. 1 E.:

O1—1 inch to 0; matted leaves and twigs.

A11—0 to 5 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; 15 percent gravel; medium acid (pH 6.0); clear wavy boundary. (5 to 10 inches thick)

A12—5 to 20 inches; very dark brown (10YR 2/2) gravelly loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular structure; soft, friable, slightly sticky and slightly plastic; few fine medium and coarse roots; 25 percent gravel; medium acid (pH 6.0); gradual irregular boundary. (10 to 15 inches thick)

A2—20 to 36 inches; dark grayish brown (10YR 4/2) cobbly loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly sticky and slightly plastic; few fine, medium, and coarse roots; 25 percent cobbles and 20 percent gravel; many krotovinas in top part of horizon; medium acid (pH 5.8); clear wavy boundary. (7 to 20 inches thick)

B2t—36 to 47 inches; yellowish brown (10YR 5/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few thin clay films; 60 percent gravel; medium acid (pH 5.8); clear wavy boundary. (7 to 14 inches thick)

C—47 to 60 inches; brown (7.5YR 5/3) very gravelly sandy clay loam, brown (7.5YR 5/4) dry; massive; hard, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; 80 percent gravel; medium acid (pH 5.8).

The mollic epipedon is 20 to 36 inches thick. The combined thickness of the A1, A2, and B2t horizons is 43 to 60 inches or more. Rock fragments are gravel and cobbles; they make up 10 to 30 percent of the A1 horizon, 40 to 55 percent of the A2 horizon, 45 to 60 percent of the B2t horizon, and 70 to 80 percent of the C horizon. Reaction is medium to slightly acid.

The A1 horizon has hue of 10YR, value of 3 though 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is loam in the upper part and loam or gravelly loam in the lower part. The A2 horizon has hue of 10YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is cobbly or very cobbly loam or very cobbly fine sandy loam. The B2t horizon has hue of 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 dry and moist. It is very gravelly clay loam or cobbly, very cobbly, or very gravelly sandy clay loam. The C horizon has hue of 10YR or 7.5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 4 dry and 3 or 4 moist. It is very gravelly or very cobbly sandy clay loam.

Foxol series

The Foxol series consists of shallow, somewhat excessively drained soils formed in material weathered from quartzite. Foxol soils are on ridges on south-, west-, and east-facing, very steep mountainsides at elevations of 5,400 to 8,500 feet. Slopes are 30 to 70 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 44 degrees F.

Foxol soils are similar to Agassiz and Choptie soils. They are near Durfee, Herd, Smarts, Yeates Hollow, and Yence soils. Agassiz soils are over limestone bedrock. Choptie soils have less than 35 percent rock fragments. Durfee soils are very deep and have more than 35 percent clay in the B2t horizon. Herd soils are very deep and have a B2t horizon that has more than 35 percent clay and less than 35 percent rock fragments. Smarts soils are deep and have a mollic epipedon more than 20 inches thick. Yeates Hollow soils are deep and have a B2t horizon that is more than 35 percent clay. Yence soils lack a mollic epipedon and have more than 35 percent clay in the B2t horizon.

Typical pedon of Foxol very cobbly loam, in an area of Foxol-Rock outcrop complex, 40 to 70 percent slopes, in Weber County, south of Squaw Flat, 350 feet south and 350 feet east of northwest corner of section 13, T. 8 N., R. 4 E.:

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and very fine roots; 70 percent cobbles; slightly acid (pH 6.4); clear wavy boundary. (7 to 10 inches thick)

A12—5 to 9 inches; very dark grayish brown (10YR 3/2) very cobbly loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; common fine and very fine pores; 60 percent cobbles; slightly acid (pH 6.4); clear wavy boundary. (0 to 5 inches thick)

B2—9 to 14 inches; brown to dark brown (7.5YR 4/2) very cobbly loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; few fine pores; 70 percent cobbles; slightly acid (pH 6.4); abrupt irregular boundary. (4 to 11 inches thick)

R—14 inches; fractured quartzite.

The mollic epipedon is 9 to 10 inches thick. Depth to bedrock is 14 to 18 inches. Rock fragments consist of cobbles and gravel; and they make up 40 to 70 percent of the A1 horizon and 60 to 70 percent of the B2 horizon. Reaction is slightly acid.

The A1 horizon has hue of 10YR, value of 4 or 5 dry and 3 moist, and chroma of 2 or 3 dry and moist. It is very cobbly loam or cobbly loam. The B2 horizon has hue of 10YR or 7.5YR, value of 5 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is very cobbly loam or very cobbly sandy clay loam.

Geertsen series

The Geertsen series consists of deep and very deep, well drained soils that formed in materials weathered from limestone, shaly limestone, or calcareous shale. Geertsen soils are dominantly on northeast-, north-, and northwest-facing high mountainsides at elevations of 6,000 to 9,100 feet. Slopes are 30 to 70 percent. The average annual precipitation is about 35 inches, and the mean annual air temperature is about 41 degrees F.

Geertsen soils are near Agassiz, Condie, and Lucky Star soils. Agassiz soils are less than 20 inches deep over bedrock. Condie soils lack a mollic epipedon, have an A2 horizon, and have hue of 5YR through 10R in the B2t horizon. Lucky Star soils have an A2 horizon, and the combined thickness of the A1, A2, and B2t horizons is 50 to 70 inches or more.

Typical pedon of Geertsen loam, in an area of Geertsen loam, 30 to 70 percent slopes, at the head of Lost Creek, approximately 10 miles north of Lost Creek Dam, about 1,100 feet west and 800 feet north of the southeast corner of section 15, T. 7 N., R. 5 E.:

A11—0 to 3 inches; very dark brown (10YR 4/2) loam, dark brown (10YR 3/3) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; neutral (pH 6.6); abrupt smooth boundary. (3 to 10 inches thick)

A12—3 to 8 inches; dark brown (10YR 3/3) heavy loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure parting to moderate fine granular structure; slightly hard, friable, slightly sticky and plastic; few fine, medium, and coarse roots; neutral (pH 6.6); abrupt smooth boundary. (0 to 9 inches thick)

B21t—8 to 11 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine, medium, and coarse roots; common thin clay films on peds; 10 percent gravel; neutral (pH 6.8); gradual wavy boundary. (0 to 6 inches thick)

B22t—11 to 45 inches; yellowish brown (10YR 5/4) very cobbly clay loam, light brown (7.5YR 6/4) dry; weak fine and medium blocky structure, size and shape of peds determined by space available between rock fragments; hard, firm, sticky and plastic; few fine, medium, and coarse roots; common thin clay films; 45 percent cobbles and 20 percent gravel; moderately calcareous; lime is disseminated; (pH 7.2); diffuse irregular boundary. (14 to 35 inches thick)

R—45 inches; fractured limestone.

The mollic epipedon is 10 to 16 inches thick. The combined thickness of the A1 and B2t horizons ranges from 28 to 50 inches. Depth to bedrock ranges from 40 to more than 60 inches. Rock fragments consist of angular limestone and shale gravel and cobbles; they make up 0 to 20 percent of the A1 horizon, 35 to 70 percent of the B2t horizon, and 65 to 70 percent of the C horizon. Reaction is slightly acid to neutral in the A1 horizon, 35 to 70 percent of the B2t horizon, and 65 to 70 percent of the C horizon. Reaction is slightly acid to neutral in the A1 and B2t horizons. Some pedons have a C horizon that is neutral to mildly alkaline.

The A1 horizon has hue of 10YR or 7.5 YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 1 through 4 dry and 1 through 3 moist. It is 5 to 13 inches thick. The B2t horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry and 3 through 5 moist, and chroma of 3 through 6 dry and 3 through 5 moist. It is dominantly very cobbly or cobbly clay loam but thin subhorizons are clay loam. The matrix is noncalcareous to moderately calcareous. Some pedons have a Cca horizon below a depth of 40 inches that has hue of 10YR or 7.5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 3 dry and 3 or 4 moist. Texture is very cobbly clay loam or gravelly loam. The Cca horizon is slightly to moderately calcareous.

Guilder series

The Guilder series consists of deep, well drained soils formed in material weathered from sandstone. Guilder soils are on north-facing mountainsides and alluvial fans at elevations of 6,400 to 8,000 feet. The slopes are 3 to 30 percent. The mean annual precipitation is about 20 inches, and the mean annual air temperature is about 41 degrees F.

Guilder soils are near Bullnel, Etchen, Ercan, Redcan, St. Marys, and Yeljack soils. Bullnel and Etchen soils are 20 to 40 inches deep to bedrock. Bullnel soils have less than 35 percent clay and have 20 to 35 percent rock fragments in the B2t horizon. Etchen soils are less than 35 percent clay and more than 35 percent rock fragments in the B2t horizon. Ercan soils have a mollic epipedon, have an A2 horizon, and are less than 35 percent clay in the B2t horizon. Redcan soils are less than 20 inches deep to bedrock and lack a B2t hozizon. St. Marys soils have a mollic epipedon, lack a B2t horizon, and are less than 35 percent clay and more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Yeljack soils have a mollic epipedon more than 20 inches thick, have an A2 horizon, and are less than 35 percent clay in the B2t horizon.

Typical pedon of Guilder loam, in an area of Guilder loam, 15 to 30 percent slopes, in Morgan County, 10 miles north and 4 miles east of Lost Creek Dam, 2,800 feet east and 200 feet south of the northwest corner of section 19, T. 7 N., R. 6 E.:

O1—1 inch to 0; decaying leaves and twigs.

A1—0 to 5 inches; dark reddish brown (5Y 3/3) loam, reddish brown (5YR 4/4) dry; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; neutral (pH 6.8); clear smooth boundary. (2 to 8 inches thick)

A3—5 to 12 inches; dark reddish brown (2.5YR 3/4) clay loam, yellowish red (5YR 4/6) dry; weak medium subangular blocky structure parting to moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; common very fine and fine pores; neutral (pH 6.8); clear smooth boundary. (0 to 7 inches thick)

B21t—12 to 22 inches; dazk red (2.5YR 3/6) heavy clay loam, red (2.5YR 4/6) dry; weak medium prismatic structure parting to moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine pores; many thin and moderately thick clay films on peds and in pores; many thin and moderately thick clay films on peds and in pores; neutral (pH 6.8); abrupt smooth boundary. (8 to 15 inches thick)

B22t—22 to 31 inches; reddish brown (2.5YR 4/4) heavy silty clay loam, red (2.5YR 4/6) dry; weak medium prismatic structure parting to moderate fine subangular blocky structure; very hard, very firm, sticky and very plastic; few very fine and fine roots; common very fine pores; common thin clay films in pores and on peds; moderately calcareous; moderately alkaline (pH 7.9); clear smooth boundary. (9 to 13 inches thick)

B23t—31 to 42 inches; dark red (2.5YR 3/6) silty clay loam, yellowish red (5YR 5/6) dry; weak coarse subangular blocky structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; few very fine and fine roots; common very fine pores; many thin and common moderately thick clay films in pores and on peds; 25 percent soft sandstone pebbles; moderately calcareous; moderately alkaline (pH 8.2); clear smooth boundary. (0 to 15 inches thick)

B24t—42 to 52 inches; dark red (2.5YR 3/6) clay loam, yellowish red (5YR 5/8) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine and fine roots; common very fine and fine pores; common thin clay films on pores and on peds; 20 percent soft sandstone pebbles; moderately calcareous; moderately alkaline (pH 8.2); clear smooth boundary. (0 to 10 inches thick)

B3ca—52 to 65 inches; red (2.5YR 4/6) loam; yellowish red (5YR 5/8) dry; weak fine subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine and fine roots; common very fine and fine pores; 20 percent soft sandstone pebbles; strongly calcareous; moderately alkaline (pH 8.2); clear smooth boundary. (13 to 23 inches thick)

Cr—65 to 77 inches; soft weathered sandstone.

The A1 horizon has moist value of less than 3.5 throughout the upper 4 inches, and chroma of 4 or more at a depth of 2 to 8 inches. The combined thickness of the Al, B2t, and B3ca horizons is 50 to more than 60 inches over bedrock. Rock fragments consist of gravel; they make up 0 to 10 percent of the Al and B2t horizons and 0 to 30 percent of the B3ca horizon. Reaction ranges from slightly acid to neutral in the Al horizon and slightly acid to moderately alkaline in the B2t horizon. The B3ca horizon is moderately or strongly calcareous.

The Al horizon has hue of 7.5YR or 5YR, value of 2 or 3 moist, and chroma of 2 through 6 dry and 2 through 4 moist. It is loam, clay loam, or sandy loam. The B2t horizon has hue of 2.5YR or 5YR, value of 4 through 6 dry and 2 through 4 moist, and chroma of 4 through 6 dry and moist. It is heavy silty clay loam or heavy clay loam. The B3ca horizon has hue of 2.5YR or 5YR, value of 4 through 6 dry and 3 or 4 moist, and chroma of 4 through 8 dry and 4 through 6 moist. It is loam, silty clay loam, clay loam, or gravelly loam.

Hades series

The Hades series consists of very deep, well drained soils formed in alluvium weathered from sedimentary rocks, mainly sandstone. Hades soils are on north-facing mountainsides and benches, alluvial fans, and stream terraces in the mountainous areas. Elevations are 5,600 to 7,600 feet. Slopes range from 6 to 60 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 41 degrees F.

Hades soils are near Croydon, Isbell, Kilfoil, Lucky Star, and Moweba soils. Croydon and Isbell soils have a mollic epipedon less than 20 inches thick. Kilfoil soils lack a mollic epipedon and are 20 to 40 inches deep over bedrock. Lucky Star soils have a mollic epipedon less than 20 inches thick, an A2 horizon, and more than 35 percent rock fragments in the layer between depths of 10 and 40 inches and in the B2t horizon. Moweba soils lack a B2t horizon and have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches.

Typical pedon of Hades loam, in an area of Hades loam, 40 to 60 percent slopes, in Coyote Canyon, about 4 miles east and 4 miles north of Croydon, 850 feet east of the west quarter-corner of section 36, T. 5 N., R. 4 E.:

A11—0 to 9 inches; very dark brown (10YR 2/2) loam, dark brown (7.5YR 4/4) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and common medium pores; medium acid (pH 6.0); abrupt smooth boundary. (2 to 11 inches thick)

A12—9 to 24 inches; very dark grayish brown (10YR 3/2) loam, dark brown (7.5YR 4/2) dry; moderate fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine and common coarse pores; medium acid (pH 6.0); abrupt wavy boundary. (12 to 29 inches thick)

B21t—24 to 40 inches; dark brown (10YR 4/3) loam, light yellowish brown (10YR 6/4) dry; weak coarse prismatic structure parting to moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; many fine and common medium pores; continuous thin clay films on peds; medium acid (pH 6.0); abrupt smooth boundary. (6 to 21 inches thick)

B22t—40 to 60 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; weak coarse prismatic structure parting to strong medium subangular blocky structure; hard, very firm, very sticky and very plastic; few fine roots; common fine pores; continuous moderately thick clay films on peds; medium acid (pH 6.0); abrupt smooth boundary. (8 to 20 inches thick)

B23t—60 to 72 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure parting to moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine pores; continuous thin clay films on peds; medium acid (pH 6.0).

The mollic epipedon is 20 to 50 inches thick. The combined thickness of the A1 and B2t horizons is 50 inches to more than 60 inches. Rock fragments consist of gravel and cobbles; they make up 0 to 20 percent of the A1 and B2t horizons and 0 to 50 percent of the C horizon. Reaction is medium acid to neutral in the A1 and B2t horizons and medium acid to moderately alkaline in the C horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam, silt loam, or light sandy clay loam. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 through 7 dry and 2 through 5 moist, and chroma of 2 through 4. It is loam, clay loam, silty clay loam, sandy clay loam, or silt loam. In some pedons a C horizon occurs below a depth of 50 to more than 60 inches. This C horizon, where present, has hue of 10YR, 2.5Y, or 5Y, value of 4 through 7 dry and 3 through 5 moist, and chroma of 2 through 4. It is cobbly loam, loam, cobbly silt loam, or silty clay loam.

Hawkins series

The Hawkins series consists of very deep, well drained soils formed in material weathered dominantly from tuffaceous sandstone. Hawkins soils are on foothills, alluvial fans, and high lake terraces at elevations of 4,850 to 6,600 feet. Slopes are 3 to 30 percent. Average annual precipitation is about 22 inches, and the mean annual air temperature is about 45 degrees F.

The Hawkins soils are near Causey, Manila, Ostler, and Yeates Hollow soils. Causey soils have less than 27 percent clay in the layer between depths of 10 and 40 inches and are calcareous throughout. Manila soils have hue of 5YR and 7.5YR in the B2t horizon. Ostler soils have a B2t horizon. Yeates Hollow soils have a B2t horizon with more than 35 percent rock fragments in the upper 20 inches.

Typical pedon of Hawkins silty clay in an area of Hawkins silty clay, 15 to 30 percent slopes, about 2 miles south of Peterson at a point 1,900 feet east and 1,300 feet north of the southwest corner of section 18, T. 4 N., R. 2 E.:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) heavy clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to moderate medium granular structure; hard, firm, sticky and plastic; many very fine and fine and few coarse roots; slightly acid (pH 6.2); abrupt smooth boundary. (2 to 13 inches thick)

B1—2 to 17 inches; very dark grayish brown silty clay, grayish brown (10YR 5/2) dry; moderate, medium and coarse subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine, and medium roots; common micro pores; common slickensides; slightly acid (pH 6.2); clear smooth boundary. (8 to 26 inches thick)

B21—17 to 27 inches; dark grayish brown (10YR 4/2) silty clay, light brownish gray (10YR 6/2) dry; weak coarse prismatic structure parting to moderate medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine, and medium roots; many micro and very fine pores; many slickensides; slightly acid (pH 6.4); clear smooth boundary. (6 to 25 inches thick)

B22—27 to 38 inches; dark grayish brown (10YR 4/2) silty clay, pale brown (10YR 6/3) dry; weak medium prismatic structure parting to moderate medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine, and medium roots common very fine pores; many slickensides; slightly acid (pH 6.4); abrupt irregular boundary. (0 to 31 inches thick)

C1ca—38 to 44 inches; brown (10YR 5/3) heavy silty clay loam; very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine and fine roots; common very fine pores; common slickensides; matrix slightly calcareous, faces of peds moderately calcareous; filamentary veins and flakes of lime; moderately alkaline (pH 8.4); abrupt wavy boundary. (0 to 14 inches thick)

C2ca—44 to 74 inches; grayish brown (2.5Y 5/2) clay loam, light gray (2.5Y 7/2) dry; moderate medium and coarse angular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common fine pores; matrix noncalcareous, faces of peds strongly calcareous; filamentary veins and flakes of lime; strongly alkaline (pH 8.6).

The mollic epipedon is 10 to more than 30 inches thick. Depth to the top of the Cca horizon ranges from 30 to 60 inches or more. The soil cracks to the surface during late summer in most years and in undisturbed areas has gilgai microrelief. Reaction is slightly acid to neutral in the A1 horizon, medium acid to mildly alkaline in the B2 horizon, and neutral to strongly alkaline in the Cca horizon. Lime ranges from noncalcareous to slightly calcareous in the B2 horizon and moderately to strongly calcareous in the Cca horizon.

The A1 horizon has hue of 10YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 dry and 1 or 2 moist. It is heavy silty clay loam or heavy clay loam. Thickness is 2 to 13 inches. The B2 horizon has dominant hue of 2.5Y or 10YR, but some pedons have hue of 5Y in some parts. Value is 5 through 7 dry and 4 or 5 moist, and chroma is 1 through 4 moist and 1 through 3 dry. The B2 horizon is silty clay, clay, heavy clay loam, or heavy silty clay loam. The Cca horizon has dominant hue of 2.5Y, but parts of some pedons have hue of 10YR. Value is 4 through 8 dry and 3 through 6 moist, and chroma is 2 through 4 dry and moist. The Cca horizon is heavy silty clay loam, heavy clay loam, or clay. Some pedons have lenses of loam, silt loam, or sandy loam in the Cca horizon.

Henefer series

The Henefer series consists of very deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Henefer soils are on very steep mountainsides and on strongly sloping alluvial fans, foothills, and stream terraces at elevations of 5,200 to 7,400 feet. Slopes range from 6 to 60 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 43 degrees F.

Henefer soils are similar to Cristo, Bertag, and Broadhead soils. They are near Durfee, Hoskin, Moweba, Poleline, and Yeates Hollow soils. Cristo soils have bedrock at a depth of 29 to 35 inches. Bertag soils have hue of 7.5YR, 10YR, or 2.5Y in the B2t horizon. Broadhead soils have hue of 10YR or 7.5YR, and the combined thickness of the A1 and B2t horizons is less than 50 inches. Durfee, Hoskin, and Yeates Hollow soils all have more than 35 percent rock fragments in the B2t horizon. Moweba and Poleline soils lack a B2t horizon and have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches.

Typical pedon of Henefer loam in an area of Henefer loam, 40 to 60 percent slopes, in Morgan County, about 3 miles northwest of Devils Slide, 1,850 feet east and 2,200 feet south of the northwest corner of section 12, T. 4 N., R. 3 E.:

A11—0 to 2 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 3/3) dry; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine and common medium roots; 5 percent gravel; neutral (pH 7.0); abrupt smooth boundary. (2 to 8 inches thick)

A12—2 to 16 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 4/3) dry; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; 10 percent gravel; neutral (pH 7.0); clear wavy boundary. (9 to 17 inches thick)

B1—16 to 28 inches; dark brown (7.5YR 3/3) gravelly silty clay loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure parting to fine and medium granular structure; slightly hard, firm, sticky and plastic; common very fine and few fine and medium roots; few thin clay films on peds; 25 percent gravel; neutral (pH 7.0); clear wavy boundary. (0 to 12 inches thick)

B21t—28 to 46 inches; reddish brown (5YR 4/3) gravelly silty clay, reddish brown (5YR 5/4) dry; strong coarse and medium angular blocky structure; extremely hard, extremely firm, sticky and very plastic; few fine roots; few very fine pores; many thin and few moderately thick clay films on peds; 20 percent gravel and 5 percent cobbles; neutral (pH 7.0); abrupt irregular boundary. (5 to 18 inches thick)

B22t—46 to 60 inches; reddish brown (5YR 4/3) very cobbly silty clay, reddish brown (5YR 5/4) dry; strong coarse and medium angular blocky structure; extremely hard, extremely firm, sticky and very plastic; few fine roots; few very fine pores; many thin and few moderately thick clay films on peds; 35 percent cobbles and 30 percent gravel; neutral (pH 7.0).

The mollic epipedon is 20 to 29 inches thick. The combined thickness of the A1, B1, and B2t horizons is more than 60 inches. Rock fragments consist mostly of pebbles and cobbles of quartzite; they make up 0 to 35 percent of the A1 and B1 horizons and the upper part of the B2t horizon, increasing with depth to 40 to 65 percent below a depth of about 45 inches. Reaction is slightly acid or neutral.

The A1 horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. It is mainly loam or silt loam but is gravelly loam in the lower part in some pedons. The B2t horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 3 through 5 moist, and chroma of 2 through 5 dry and 2 through 4 moist. It is gravelly or cobbly silty clay or clay, heavy clay loam, or very cobbly silty clay.

Henhoit series

The Henhoit series consists of very deep, well drained soils formed in materials weathered mostly from a conglomerate of quartzite and sandstone. Henhoit soils are on very steep mountainsides at elevations of 5,200 to 7,700 feet. The slopes are 30 to 60 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 43 degrees F.

The Henhoit soils are similar to Durst, Holmes, Horrocks, and Hoskin soils. They are near Etchen, Morgala, Morcan, St. Marys, and Schuster soils. Durst and Hoskin soils are 20 to 40 inches deep over bedrock. Holmes, Horrocks, and Hoskin soils have more than 75 percent base saturation in all parts of the profile above a depth of 30 inches. Holmes and Horrocks soils have combined A1 and B2t horizons less than 30 inches thick, and lack hue as red as 2.5YR in the B2t horizon. Etchen soils lack a mollic epipedon and are 21 to 40 inches deep to bedrock. Morgala and Norcan soils have less than 35 percent rock fragments and more than 35 percent clay in the argillic horizon. St. Marys soils lack an argillic horizon. Schuster soils have an A2 horizon, and summer soil temperatures are less than 59 degrees F.

Typical pedon of Henhoit gravelly loam, in an area of Henhoit gravelly loam, 30 to 60 percent slopes, about 4 miles southwest of Porterville in Tucker Hollow, 1,000 feet west and 500 feet north of the southeast corner of section 3, T. 2 N., R. 2 E.:

O1—3 inches to 0; matted leaves, twigs, and stems. (1 to 3 inches thick)

A11—0 to 2 inches; dark reddish brown (5YR 3/2) gravelly loam, dark reddish brown (5YR 3/3) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 20 percent gravel; medium acid (pH 5.8); abrupt wavy boundary. (2 to 10 inches thick)

A12—2 to 10 inches; dark reddish brown (5YR 3/3) gravelly loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure parting to weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium and few coarse roots; 20 percent gravel; medium acid (pH 5.8); clear smooth boundary. (0 to 11 inches thick)

B21t—10 to 25 inches; dark red (2.5YR 3/6) very gravelly clay loam, red (2.5YR 4/6) dry; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; common very fine, fine, and medium and few coarse roots; few very fine and fine pores; common thin clay films on peds and in pores; 35 percent gravel and 20 percent cobbles; medium acid (pH 5.6); clear smooth boundary. (6 to 22 inches thick)

B22t—25 to 50 inches; dark red (2.5YR 3/6) very gravelly clay loam, red (2.5YR 4/6) dry; moderate coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and few fine pores; common thin clay films on peds and in pores; 35 percent gravel, 25 percent cobbles; medium acid (pH 5.7); abrupt wavy boundary. (9 to 28 inches thick)

B3t—50 to 60 inches; dark red (2.5YR 3/6) very gravelly clay loam, red (2.5YR 4/6) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; 40 percent gravel and 25 percent cobbles; slightly calcareous, lime disseminated; mildly alkaline (pH 7.4). (0 to 22 inches thick)

The mollic epipedon ranges from 10 to 19 inches thick. The combined thickness of the A1 and B2t horizons ranges from 50 to 60 inches or more. Base saturation is less than 75 percent in some part or in all of the soil above a depth of 30 inches. Rock fragments consist of rounded quartzite and sandstone of cobble and pebble size; they make up 20 to 45 percent of the A1 horizon and 35 to 70 percent of the B2t horizon. Reaction ranges from medium acid to neutral.

The A1 horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is gravelly, very gravelly, or cobbly loam. The B2t horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 through 8 dry and moist. It is very gravelly, very cobbly, or cobbly clay loam or gravelly or very gravelly loam.

Herd series

The Herd series consists of deep and very deep, well drained soils formed in glacial till from a conglomerate of sandstone and quartzite over material weathered from sandstone. Herd soils are on high mountaintops and ridges. Slopes are 3 to 25 percent but are dominantly 3 to 15 percent. Elevations range from 7,000 to 9,000 feet. Average annual precipitation is about 30 inches, and the mean annual air temperature is about 41 degrees F.

Herd soils are near Charcol, Lucky Star, Moweba, and Yence soils. Charcol, Lucky Star, and Moweba soils are more than 35 percent rock fragments and less than 35 percent clay between depths of 10 and 40 inches. Charcol and Moweba soils have a mollic epipedon more than 20 inches thick, and Lucky Star soils have a mollic epipedon 10 to 20 inches thick. Yence soils have more than 35 percent rock fragments in the B2t horizon.

Typical pedon of Herd cobbly clay loam, in an area of Herd-Yence complex, 3 to 15 percent slopes, about 11 miles north and 2 miles west of Croydon on Herd Mountain at intersection of landing strip, about 240 feet south and 2,000 feet west of the northeast corner of section 25, T. 6 N., R. 3 E.:

A11—0 to 3 inches; very dark brown (10YR 2/2) cobbly clay loam, dark yellowish brown (10YR 4/4) dry; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and very fine roots; 20 percent cobbles, 10 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary. (3 to 9 inches thick)

A12—3 to 10 inches; brown (7.5YR 4/2) cobbly clay loam, brown (7.5YR 5/4) dry; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few very fine pores; 20 percent cobbles, 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (0 to 9 inches thick)

A13—10 to 20 inches; brown (7.5YR 4/4) cobbly clay loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few coarse roots; few very fine pores; 15 percent cobbles, 10 percent gravel; medium acid (pH 5.6); clear irregular boundary. (5 to 11 inches thick)

IIB21t—20 to 29 inches; yellowish red (5YR 4/6) clay, yellowish red (5YR 5/6) dry, faces of peds are brown (7.5YR 4/2) and light yellowish brown (10YR 6/4) dry; weak medium prismatic structure

parting to moderate medium and coarse subangular blocky structure; very hard, very firm, sticky and very plastic; few fine and medium roots; common very fine and few fine pores; common moderately thick clay films on peds; common slickensides on peds; 2 percent gravel; strongly acid (pH 5.4); clear smooth boundary. (6 to 16 inches thick)

IIB22t—29 to 36 inches; yellowish red (5YR 4/8) clay, yellowish red (5YR 5/6) dry; faces of peds are red (2.5YR 4/8) and light brown (7.5YR 6/4) dry and red (2.5YR 4/6) and brown (7.5YR 5/4) moist; weak medium prismatic structure parting to moderate medium and coarse subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine and medium roots; common very fine and fine pores; common moderately thick clay films on peds; common slickensides on peds; 2 percent gravel; strongly acid (pH 5.4); clear smooth boundary. (0 to 18 inches thick)

IIB23t—36 to 43 inches; red (2.5YR 4/6) clay loam, red (2.5YR 5/6) dry; faces of peds are red (2.5YR 5/8) and light brown (7.5YR 6/4) dry and red (2.5YR 4/8) and brown (7.5YR 5/4) moist; weak medium prismatic structure parting to moderate medium angular blocky structure; extremely hard, very firm, sticky and very plastic; few fine and medium roots; common very fine and fine pores; continuous moderately thick clay films on peds and in pores; 5 percent soft gravel; strongly acid (pH 5.4) clear smooth boundary. (0 to 20 inches thick)

IIB3t—43 to 50 inches; red (2.5YR 4/8) clay loam, red (2.5YR 4/6) dry; faces of peds are red (2.5YR 5/8) and light brown (7.5YR 6/4) dry and red (2.5YR 4/8) and light brown (7.5YR 6/4) moist; moderate medium and coarse angular blocky structure; extremely hard, very firm, slightly sticky and plastic; few fine roots; few very fine pores; continuous moderately thick clay films on peds and in pores; 20 percent weathered sandstone gravel; strongly acid (pH 5.4); clear smooth boundary. (0 to 7 inches thick)

C—50 to 70 inches; red (10YR 4/6) gravelly clay loam, red (2.5YR 5/6) dry; faces of peds are red (2.5YR 4/8) dry and red (10YR 4/6) moist; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; few very fine roots; 40 percent weathered sandstone gravel; strongly acid (pH 5.2).

The combined thickness of the A1 and IIB2t horizons is 50 to more than 60 inches over bedrock or underlying C horizon. Rock fragments consist of rounded quartzite gravel and cobbles; they make up 20 to 35 percent of the A11 horizon and 15 to 50 percent of the A12 and A13 horizons. The IIB2t horizon has 0 to 20 percent sandstone gravel and cobbles. Reaction ranges from medium acid to neutral in the A horizon and strongly acid to slightly acid in the IIB2t horizon.

The A11 horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. The A12 and A13 horizons have hue of 10YR, 7.5YR, or 5YR, value of 4 through 7 dry and 3 through 5 moist and chroma of 3 through 6 dry and 2 through 6 moist. Either moist chroma or moist value is 4 or more in all parts. It is cobbly or very cobbly clay loam, cobbly or gravelly loam, cobbly silt loam, loam, or silt loam. The IIB2t horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 through 6 dry and moist, chroma of 4 through 8 dry and 3 through 8 moist. It is clay, clay loam, or silty clay.

Holmes series

The Holmes series consists of very deep, well drained soils formed in alluvium weathered from quartzite and sandstone. Holmes soils are on north- and west-facing, strongly sloping alluvial fans at elevations of 5,000 to 5,700 feet. Slopes are 3 to 10 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 44 degrees F.

Holmes soils are similar to Horrocks and Hoskin soils. They are near Burgi, Durfee, Manila, Nebeker, St. Marys, and Yeates Hollow soils. Horrocks soils have soft bedrock at a depth of 45 to 54 inches. Hoskin soils have bedrock at a depth of 24 to 39 inches. Burgi and St. Marys soils lack a B2t horizon. Burgi soils have a mollic epipedon more than 20 inches thick. Durfee and Yeates Hollow soils have more than 35 percent clay in the B2t horizon. Manila and Nebeker soils have more than 35 percent clay and less than 20 percent rock fragments in the B2t horizon.

Typical pedon of Holmes very stony loam, in an area of Holmes very stony loam, high rainfall, 3 to 10 percent slopes, in Weber County, 2 1/2 miles south and 2 miles east of Huntsville Monastery, 660 feet east and 50 feet north of the south quarter-corner of section 36, T. 6 N., R. 2 E.:

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) very stony loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine and few medium pores; 25 percent gravel, 20 percent surface stones; medium acid (pH 5.8); abrupt wavy boundary. (3 to 5 inches thick)

A12—5 to 11 inches; very dark grayish brown (10YR 3/2) cobbly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine and fine and few medium pores; 25 percent cobbles and 20 percent gravel; medium acid (pH 5.8); clear wavy boundary. (6 to 17 inches thick)

B21t—11 to 21 inches; dark brown (7.5YR 4/4) very cobbly clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine and medium roots; many very fine and few fine pores; common thin clay films on peds; 35 percent stones, 30 percent cobbles, and 10 percent gravel; medium acid (pH 5.8); clear wavy boundary. (7 to 11 inches thick)

B22t—21 to 32 inches; dark brown (7.5YR 4/4) very cobbly clay loam, dark brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine pores; common thin clay films on peds; 30 percent stones, 20 percent cobbles, and 20 percent gravel; medium acid (pH 5.8); abrupt wavy boundary. (0 to 11 inches thick)

C1—32 to 50 inches; dark brown (7.5YR 6/4) very gravelly sandy loam, light brown (7.5YR 6/4) dry; single grained; loose; few very fine and fine roots; common very fine and few fine pores; 40 percent gravel, 30 percent cobbles, and 10 percent stones; medium acid (pH 5.8); clear wavy boundary. (6 to 20 inches thick)

C2—50 to 61 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, light brown (7.5YR 6/4) dry; single grained; loose; few very fine roots; 25 percent stones, 20 percent cobbles, and 30 percent gravel; medium acid (pH 5.8).

The mollic epipedon is 11 to 20 inches thick. The combined thickness of the A1 and B2t horizons is 16 to 32 inches. The B2t horizon is underlain by very gravelly or very cobbly sandy loam, loamy sand, or sand. Rock fragments consist of rounded gravel, cobbles, and some stones; they make up 20 to 45 percent of the A1 horizon, with a surface cover of 10 to 25 percent stones, 40 to 75 percent of the B2t horizon and 60 to 85 percent of the C horizon. Reaction is medium to slightly acid.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 dry and 3 moist, and chroma of 2 through 4 dry and 2 moist. It is very stony or gravelly or cobbly loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is cobbly or very cobbly clay loam with 19 to 35 percent clay. The C horizon has hue of 7.5YR, value of 4 through 6 dry and 3 or 4 moist, and chroma of 4 dry and 2 through 4 moist. It is very gravelly or very cobbly sandy loam, loamy sand, or sand.

Horrocks series

The Horrocks series consists of deep, well drained soils formed in material weathered from limestone. Horrocks soils are on very steep south- and west-facing mountainsides at elevations of 5,400 to 7,600 feet. Slopes are 40 to 70 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 43 degrees F.

Horrocks soils are similar to Holmes and Hoskin soils. They are near Agassiz, Condie, Geertsen, and Poleline soils. Holmes soils have a very gravelly loam or sandy loam B2t horizon. Hoskin soils have bedrock at a depth of 24 to 39 inches. Agassiz soils have bedrock at a depth of less than 20 inches. Condie, Geertsen, and Poleline soils all have an average summer soil temperature less than 59 degrees F. Condie soils lack a mollic epipedon and have an A2 horizon. Poleline soils have a mollic epipedon 17 to 35 inches thick and lack a B2t horizon.

Typical pedon of a Horrocks gravelly loam in an area of Horrocks-Rock outcrop complex, 40 to 70 percent slopes, in Morgan County, about 8 miles north and 1 mile east of Morgan County Courthouse, at a point 1,500 feet east and 1,100 feet north of the southwest corner of section 19, T. 5 N., R. 3 E.:

A11—0 to 6 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine pores; 15 percent angular gravel, 5 percent angular cobbles; slightly acid (pH 6.2); clear smooth boundary. (4 to 8 inches thick)

A12—6 to 15 inches; very dark grayish brown (10YR 3/2) cobbly loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and few fine and medium roots; few micro pores; 20 percent angular cobbles, 5 percent angular gravel; slightly acid (pH 6.2); gradual wavy boundary. (6 to 11 inches thick)

B21t—15 to 26 inches; dark brown (7.5YR 4/2) very cobbly clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; common micro and few fine pores; few thin clay films in pores; 25 percent angular gravel, 30 percent angular cobbles; slightly acid (pH 6.2); gradual irregular boundary. (5 to 11 inches thick)

B22t—26 to 37 inches; dark brown (7.5YR 4/4) very cobbly clay loam, brown (7.5YR 5/4) dry; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; common micro and few fine pores; few thin clay films in pores; 30 percent gravel, 30 percent angular cobbles; slightly calcareous; lime disseminated; mildly alkaline (pH 7.6); gradual wavy boundary. (6 to 16 inches thick)

B23t—37 to 45 inches; dark brown (7.5YR 4/4) gravelly clay loam, light brown (7.5YR 6/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; common micro pores; few thin clay films in pores; 20 percent angular cobbles, 25 percent angular gravel; slightly calcareous; lime disseminated; mildly alkaline (pH 7.6); clear smooth boundary. (0 to 15 inches thick)

Cr—45 to 64 inches; weathered shale.

The mollic epipedon is 10 to 16 inches thick. The B2t horizon is underlain by weathered shale or limestone at a depth of 45 to 54 inches. Rock fragments consist of angular gravel and cobbles; they make up 20 to 25 percent of the A1 horizon and 35 to 60 percent of the B2t horizon. Reaction is slightly acid to medium acid in the A1 horizon, slightly acid in the upper part of the B2t horizon, and neutral or mildly alkaline in the lower part. The lower part of the B2t horizon is slightly to moderately calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 or 3 moist and 4 or 5 dry, and chroma of 2 or 3 moist and 2 or 4 dry. It is gravelly loam in the upper part and cobbly loam in the lower part. The B2t horizon has hue of 10YR or 7.5YR, value of 4 moist and 5 or 6 dry, and chroma of 2 through 4 moist and 3 through 6 dry. It is gravelly, very gravelly, cobbly, or very cobbly clay loam or cobbly loam.

Hoskin series

The Hoskin series consists of moderately deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Hoskin soils are on very steep, south- and west-facing mountainsides at elevations of 5,300 to 7,000 feet. Slopes are 30 to 70 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 43 degrees F.

Hoskin soils are similar to Holmes and Horrocks soils. They are near Henefer, Moweba, and St. Marys soils. All of these soils lack bedrock above a depth of more than 40 inches. Henefer soils have more than 35 percent clay in the upper 20 inches of the B2t horizon. Henefer and Moweba soils have a mollic epipedon more than 20 inches thick. St. Marys soils lack a B2t horizon.

A typical pedon of a Hoskin cobbly loam in an area of St. Marys-Hoskin cobbly loams, 30 to 50 percent slopes, in Morgan County, about 1 3/4 miles north and 1 1/4 mile west of Croydon at a point 1,880 feet west and 1,600 feet south of the northwest corner of section 7, T. 4 N., R. 4 E.:

A11—0 to 4 inches; dark reddish brown (5YR 3/2) cobbly loam, dark reddish gray (5YR 4/2) dry; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; 25 percent cobbles and 15 percent gravel; neutral reaction (pH 7.0); clear smooth boundary. (4 to 12 inches thick)

A12—4 to 14 inches; dark reddish brown (5YR 3/2) cobbly loam, reddish brown (5YR 4/4) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; few fine pores; 25 percent cobbles and 25 percent gravel; neutral (pH 6.8); clear smooth boundary. (0 to 10 inches thick)

B21t—14 to 21 inches; dark reddish brown (5YR 3/4) very cobbly sandy clay loam, reddish brown (5YR 5/4) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; few thin clay films on peds and in pores; 40 percent cobbles and 30 percent gravel; neutral (pH 6.6); clear wavy boundary. (4 to 12 inches thick)

B22t—21 to 28 inches; dark red (2.5YR 3/6) very cobbly sandy clay loam, red (2.5YR 4/6) dry; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine pores; few thin clay films on peds and in some pores; 70 percent rock fragments, 40 percent cobbles, and 30 percent gravel; slightly acid (pH 6.4); clear wavy boundary. (0 to 15 inches thick)

R—28 to 31 inches; weathered conglomerate of sandstone and quartzite.

The mollic epipedon is 9 to 19 inches thick. The B2t horizon is underlain by bedrock at a depth of 24 to 39 inches. Rock fragments consist mainly of rounded quartzite gravel and cobbles; they make up 20 to 50 percent of the A1 horizon and 35 to 70 percent of the B2t horizon. Reaction is slightly acid through mildly alkaline.

The A1 horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is cobbly, very cobbly, or gravelly loam, cobbly clay loam, or sandy clay

loam. The B2t horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 through 6 dry and 2 through 6 moist. It is very cobbly sandy clay loam, loam, or gravelly clay loam.

Isbell series

The Isbell series consists of very deep, well drained soils formed in materials weathered from sandstone and shale. Isbell soils are dominantly on south- or west-facing, very steep mountainsides, alluvial fans, and stream terraces. Slopes are 6 to 60 percent, and elevations range from 5,400 to 7,550 feet. Average annual precipitation is about 22 inches, and the mean annual air temperature is about 41 degrees F.

Isbell soils are similar to Cloud Rim soils. They are near Croydon, Kilfoil, Lucky Star, Moweba, and Hades soils. Cloud Rim soils have a combined thickness of the A1 and B2t horizons that is more than 50 inches. Croydon and Lucky Star soils have an A2 horizon and have cooler summer temperatures. Moweba soils have a mollic epipedon more than 20 inches thick and have more than 35 percent rock fragments in layer between depths of 10 and 40 inches. Hades soils have a mollic epipedon more than 20 inches thick. Kilfoil soils lack a mollic epipedon and are 20 to 40 inches deep to bedrock.

Typical pedon of Isbell loam in an area of Isbell loam, 40 to 60 percent slopes, about 3 miles north and 5 miles east of Croydon along a stock road, at a point 2,200 feet west and 1,350 feet south of the northeast corner of section 6, T. 4 N., R. 5 E.:

O1—1 inch to 0; matted leaves and stems.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 4/3) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; neutral (pH 6.8); clear smooth boundary. (3 to 8 inches thick)

A12—4 to 8 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 4/3) dry; weak medium subangular blocky structure parting to moderate medium granular structure; hard, friable, slightly sticky and slightly plastic; common fine roots; 10 percent cobbles; neutral (pH 6.8); clear wavy boundary. (3 to 12 inches thick)

B21t—8 to 18 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 4/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; common thin and moderately thick clay films on peds; 15 percent cobbles; neutral (pH 7.0); clear smooth boundary. (5 to 21 inches thick)

B22t—18 to 25 inches; dark grayish brown (10YR 4/2) clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; few fine and medium pores; common thin clay films; 15 percent gravel; slightly calcareous; neutral (pH 7.0); clear smooth boundary. (5 to 22 inches thick)

C1—25 to 36 inches; olive brown (2.5Y 4/4) silty clay, pale brown (10YR 4/3) dry; moderate medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine roots; slightly calcareous; veins of lime; strongly alkaline (pH 8.6); clear smooth boundary. (11 to 24 inches thick)

C2—36 to 48 inches; olive (5Y 5/3) light silty clay, pale olive (5Y 6/3) dry; moderate medium angular blocky structure; extremely hard, very firm, sticky and very plastic; few fine roots; slightly calcareous, veins of lime; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 24 inches thick)

C3—48 to 60 inches; light olive brown (2.5Y 5/4) loam, pale olive (5Y 6/3) dry; weak medium angular blocky structure; very hard, firm, slightly sticky and slightly plastic; moderately calcareous; strongly alkaline (pH 8.6).

The mollic epipedon is 10 to 20 inches thick and extends into the B2t horizon in most pedons. The combined thickness of the A1 and B2t horizons is 25 to 50 inches. Weathered sandstone and shale occur at a depth of 40 to 60 inches or more. Rock fragments consist mostly of angular gravel and cobbles; and they make up 0 to 20 percent of the profile. In Isbell loam, gravelly substratum, 6 to 15 percent slopes, rounded gravel and cobbles make up 35 to 70 percent of the C horizon. Reaction is slightly acid to neutral in the A1 or B2t horizons and slightly acid to strongly alkaline in the C horizon. The B2t horizon is dominantly noncalcareous but is slightly calcareous in the lower part of some pedons. The C horizon is noncalcareous to moderately calcareous.

The A1 horizon has hue of 7.5YR through 2.5Y but dominantly 10YR. Value is 3 through 5 dry and 2 or 3 moist, and chroma is 1 through 3 dry and moist. The B2t horizon has hue of 7.5YR through 2.5Y, value of 5 through 7 dry and 3 through 5 moist, and chroma of 2 through 4 dry and moist. It is clay loam, silty clay loam, or sandy clay loam. The C horizon has hue of 10YR, 2.5Y, and 5Y, value of 5 through 7 dry and 4 or 5 moist, and chroma of 1 through 4 dry and moist. It is silty clay, loam, or silty clay loam.

Kahler series

The Kahler series consists of very deep, well drained soils that formed in alluvium weathered from argillite, schist, and phyllite. Kahler soils are dominantly on north- and east-facing, long, sloping or strongly sloping alluvial fans at elevations of 5,100 to 5,550 feet. Slopes range from 3 to 10 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 45 degrees F.

Kahler soils are similar to Eastcan soils. They are near Lamondi, Manila, and Utaba soils. Eastcan soils have a seasonal high water table at a depth of 25 to 36 inches. Lamondi and Utaba soils have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Manila soils have a mollic epipedon less than 20 inches thick and have a B2t horizon that is more than 35 percent clay and more than 35 percent gravel.

Typical pedon of Kahler gravelly loam in an area of Kahler gravelly loam, 6 to 10 percent slopes, in Weber County, 1 mile south of Liberty, 1,320 feet east and 1,080 feet south of the northwest corner of section 29, T. 7 N., R. 1 E.:

Ap—0 to 6 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; common very fine pores; 20 percent gravel; slightly acid (pH 6.1); abrupt smooth boundary. (6 to 9 inches thick)

A12—6 to 20 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; many very fine and fine and few medium and coarse pores; 20 percent gravel; slightly acid (pH 6.1); gradual wavy boundary. (6 to 22 inches thick)

A13—20 to 25 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; many very fine and fine and few medium pores; 20 percent gravel; slightly acid (pH 6.1); clear smooth boundary. (0 to 11 inches thick)

A14—25 to 35 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and plastic; few very fine roots; many very fine and fine and few medium pores; 15 percent gravel; slightly acid (pH 6.1); clear smooth boundary. (0 to 10 inches thick)

B21—35 to 53 inches; brown (10YR 4/3) very gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine and fine pores; 15 percent cobbles and 40 percent gravel; slightly acid (pH 6.1); gradual wavy boundary. (7 to 18 inches thick)

B22—53 to 63 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; many fine and very fine pores; 10 percent gravel; slightly acid (pH 6.1).

The mollic epipedon is 20 to 35 inches thick. Rock fragments are gravel and cobbles; they make up 15 to 30 percent of the A1 horizon, 20 to 55 percent of the B2 horizon, 0 to 70 percent of the C horizon, and average 20 to 35 percent of the layer between depths of 10 and 40 inches. Reaction is slightly acid or neutral in the A1 horizon and slightly acid in the B2 and C horizons.

The A1 horizon has hue of 10YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. It is loam, gravelly loam, or silt loam. The B2 horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry and 3 through 5 moist, and chroma of 3 through 6 dry and 3 or 4 moist. It ranges from gravelly, very gravelly, or cobbly loam to gravelly silt loam or sandy loam. The C horizon has hue of 10YR or 7.5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 4 dry and 3 or 4 moist. It ranges from silt loam to very gravelly loam.

Kilfoil series

The Kilfoil series consists of moderately deep, well drained soils formed in material weathered from sandstone and shale. Kilfoil soils are on the south-facing mountainsides at elevations of 5,500 to 7,700 feet. The slopes range from 25 to 60 percent. The average annual precipitation is about 20 inches, and the mean annual temperature is about 41 degrees F.

Kilfoil soils are similar to Bullnel soils. They are near Croydon, Hades, Isbell, Moweba, and St. Marys soils. All of these soils except Bullnel soils are more than 40 inches deep to bedrock. Bullnel soils have hue of 10R, 2.5YR, and 5YR in the B2t horizon. Croydon soils have a mollic epipedon, an A2 horizon, and cooler temperatures during summer. Isbell soils have a mollic epipedon. Moweba soils have a mollic epipedon more than 20 inches thick and are more than 35 percent rock fragments in the layer between depths of 10 to 40 inches. St. Marys soils have a mollic epipedon and are more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Hades soils have a mollic epipedon more than 20 inches thick.

Typical pedon of Kilfoil loam in an area of Kilfoil-Rock outcrop complex, 40 to 60 percent slopes, 4 1/2 miles east and 7 miles north of Croydon, about 850 feet west and 2,500 feet south of the northeast corner of section 13, T. 5 N., R. 4 E.:

A11—0 to 1 inch; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium platy structure parting to moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many fine pores; mildly alkaline (pH 7.6); abrupt smooth boundary. (1 to 4 inches thick)

A12—1 to 3 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; few very fine pores; 10 percent weathered angular gravel; slightly calcareous; mildly alkaline (pH 7.8); abrupt smooth boundary. (2 to 5 inches thick)

B21t—3 to 7 inches; dark brown (10YR 3/3) clay loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure parting to moderate medium granular structure; slightly hard, firm, sticky and slightly plastic; common very fine, fine, and medium roots; few fine pores; common thin clay films on peds; 5 percent weathered angular gravel; slightly calcareous; moderately alkaline (pH 8.0); clear smooth boundary.

B22t—7 to 21 inches; dark brown (10YR 4/3) clay loam, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure parting to moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine, fine, and medium roots; common fine and few coarse pores; common thin clay films on peds; 10 percent weathered angular gravel; moderately calcareous, lime disseminated; moderately alkaline (pH 8.4); abrupt irregular boundary. (6 to 18 inches thick)

Cca—21 to 30 inches; yellowish brown (10YR 5/4) gravelly loam, very pale brown (10YR 7/3) dry; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; few very fine and medium roots; common fine and few coarse pores; 35 percent weathered angular gravel; moderately calcareous; disseminated and veins of lime; strongly alkaline (pH 8.6). (6 to 10 inches thick)

Cr—30 to 40 inches; weathered sandstone and shale bedrock.

The top of the Cca horizon is immediately below the B2t horizon at a depth of 13 to 35 inches. Depth to weathered and fractured bedrock ranges from 21 to 40 inches. Rock fragments range from 0 to 20 percent in the A1 and B2t horizons and 10 to 70 percent in the Cca horizon. Rock fragments in the B2t and Cca horizons consist of weathered angular fragments of sandstone and shale. Reaction is neutral through strongly alkaline. The soil is noncalcareous to moderately calcareous in the A1 horizon, slightly to strongly calcareous in the B2t horizon, and moderately to strongly calcareous in the Cca horizon.

The A1 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 through 6 dry and 2 through 4 moist, and chroma of 2 through 4 dry and moist. It is loam or silt loam. The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 through 7 dry and 4 or 5 moist, and chroma of 2 through 4 dry and moist. It is clay loam, silty clay loam, silt loam, loam, cobbly sandy clay loam, or gravelly silt loam. The Cca horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 through 7 dry and 4 or 5 moist, and chroma of 1 through 6 dry and 1 through 4 moist. It is a gravelly or very cobbly loam, loam, sandy clay loam, or very gravelly silt loam.

Lamondi series

The Lamondi series consists of very deep, well drained soils formed in alluvium weathered from argillite, phyllite, schist, and quartzite. Lamondi soils are on alluvial fans on mountain footslopes at elevations of 5,100 to 7,000 feet. The slopes are 3 to 30 percent. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 45 degrees F.

Lamondi soils are similar to Moweba soils. They are near Brownlee, Nordic, Patio, and Poleline soils. Moweba soils have a hue of 7.5YR, 5YR, and 2.5YR in all parts of the B2 horizon. Nordic soils have A2 and B2t horizons and cooler summer temperatures. Patio soils are moderately deep over bedrock. Poleline soils have cooler temperatures during the summer months. Brownlee soils have a B2t horizon with less than 20 percent rock fragments and have a mean annual soil temperature of more than 47 degrees F.

Typical profile of a Lamondi stony loam in an area of Lamondi stony loam, 3 to 15 percent slopes, about 1 1/2 miles south of Liberty, 1,000 feet west and 700 feet south of the east quarter-corner of section 29, T. 7 N., R. 1 E.:

A11—0 to 3 inches; very dark brown (10YR 2/2) stony loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, friable, slightly sticky and plastic; many very fine and fine roots; 20 percent gravel; 3 percent of surface covered by stones; slightly acid (pH 6.4); abrupt smooth boundary. (3 to 8 inches thick)

A12—3 to 10 inches; very dark brown (10YR 2/2) cobbly loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; few fine and very fine pores; 10 percent cobbles, 10 percent gravel; slightly acid (pH 6.3); gradual smooth boundary. (6 to 12 inches thick)

A13—10 to 21 inches; very dark grayish brown (10YR 3/2) cobbly loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine and medium granular structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine and few medium roots; common fine and very fine pores; 15 percent cobbles, 5 percent gravel, 30 percent stones; slightly acid (pH 6.2); clear smooth boundary. (0 to 12 inches thick)

B21—21 to 36 inches; dark yellowish brown (10YR 4/4) very cobbly loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine pores; 25 percent cobbles, 15 percent gravel, 30 percent stones; medium acid (pH 6.0); clear smooth boundary. (7 to 20 inches thick)

B22—36 to 52 inches; yellowish brown (10YR 5/4) very cobbly loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; many very fine pores; 25 percent cobbles, 15 percent gravel, 30 percent stones; medium acid (pH 5.8); clear smooth boundary. (12 to 20 inches thick)

B3—52 to 61 inches; dark yellowish brown (10YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine and fine pores; few thin clay films; 65 percent gravel; medium acid (pH 5.8).

The mollic epipedon is 20 to 26 inches thick. Base saturation is less than 75 percent in at least some part of the upper 30 inches. The layer between depths of 10 and 40 inches has 20 to 30 percent clay and 35 to 65 percent rock fragments. Rock fragments in the soil consist of angular and rounded gravel, cobbles, and stones; they make up 20 to 55 percent of the A1 horizon, 45 to 70 percent of the B2 horizon, and 60 to 70 percent of the C horizon. The reaction is medium to slightly acid.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is stony loam at the surface and cobbly, very cobbly, or gravelly loam in the lower part. The B2 horizon has hue of 10YR or 7.5YR, value of 5 through 6 dry and 4 or 5 moist, and chroma of 3 through 6 dry and 3 or 4 moist. It is very cobbly, very gravelly, cobbly, or gravelly loam, clay loam, or very cobbly sandy clay loam. The C horizon has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 3 or 4 dry and moist. It is very gravelly loam or clay loam, very cobbly loam, very cobbly sandy loam, or very cobbly loamy sand.

Lucky Star series

The Lucky Star series consists of very deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Lucky Star soils are on north- and east-facing, moderately steep or very steep mountainsides and moderately steep or steep alluvial fans. Slopes range from 15 to 60 percent. The elevations are 6,000 to 8,500 feet. Average annual precipitation is about 35 inches, and the mean annual air temperature is about 41 degrees F.

Lucky Star soils are similar to Nordic and Schuster soils. They are near Charcol, Condie, Ercan, Herd, and Moweba soils. Nordic and Schuster soils lack A and B horizons. Nordic soils have hue of 7.5YR or 10YR in the B2t horizon. Charcol soils have a mollic epipedon more than 20 inches thick. Condie soils lack a mollic epipedon. Ercan soils have less than 35 percent rock fragments in the B2t horizon. Herd soils lack a mollic epipedon and have more than 35 percent clay and less than 35 percent rock fragments in the B2t horizon. Moweba soils have a mollic epipedon more than 20 inches thick and lack a B2t horizon.

Typical pedon of Lucky Star silt loam in an area of Lucky Star silt loam, 30 to 60 percent slopes, in Morgan County, 4 1/4 miles east and 1 mile north of Croydon at a point 2,200 feet south of the north quarter-corner of section 18, T. 4 N., R. 5 E.:

O1—2 inches to 0; leaves.

A11—0 to 6 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine and few coarse roots; 10 percent gravel; neutral (pH 6.6); clear smooth boundary. (3 to 14 inches thick)

A12—6 to 19 inches; very dark brown (10YR 2/2) gravelly silt loam, dark brown (10YR 3/3) dry; weak medium subangular blocky structure parting to moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; few fine pores; 25 percent gravel; neutral (pH 6.6); abrupt irregular boundary. (0 to 14 inches thick)

A21—19 to 34 inches; brown (7.5YR 4/4) gravelly loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; few fine pores; 35 percent gravel; slightly acid (pH 6/4); diffuse wavy boundary. (8 to 20 inches thick)

A22—34 to 47 inches; brown (7.5YR 44) very gravelly sandy loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; few fine pores; 55 percent gravel; slightly acid (pH 6.4); clear irregular boundary. (6 to 17 inches thick)

A&B—47 to 58 inches; this horizon consists of 80 percent A2, brown (7.5YR 4/4) very gravelly loam, pink (7.5YR 7/4) dry; massive; slightly hard, loose, nonsticky and nonplastic; and 20 percent B2t, brown (7.5YR 4/4) very gravelly clay loam, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; many thin and common moderately thick clay films on peds; 60 percent gravel; slightly acid (pH 6.2); diffuse wavy boundary. (7 to 25 inches thick)

A&B2—58 to 74 inches; this horizon consists of 80 percent A2, reddish brown (5YR 4/4) very gravelly light sandy loam, light brown (7.5YR 6/4) dry; single grained; loose; and 20 percent B2t, reddish brown (5YR 4/4) very gravelly clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; many thin and common moderately thick clay films on peds; 70 percent gravel and cobbles; slightly acid (pH 6.4).

The mollic epipedon is 13 to 20 inches thick. The thickness of the solum is more than 60 inches. The layer between depths of 10 and 40 inches is 9 to 20 percent clay and 35 to 50 percent rock fragments. Rock fragments are quartzite and sandstone; they are from 10 to 30 percent gravel in the A1 horizon and 35 to 70 percent gravel and cobbles in the A2, A&B, and B2t horizons. Reaction is medium acid through neutral.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is silt loam, loam, or gravelly silt loam. The A2 horizon has hue of 10YR, 7.5YR, or 5YR, value of 6 or 7 dry and 3 through 6 moist, and chroma of 2 through 6 dry and moist. It is gravelly, cobbly, or very cobbly loam; gravelly, very gravelly, cobbly, or very cobbly sandy loam; or very

gravelly or very cobbly fine sandy loam. The B2t part of the A&B horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 through 7 dry and 3 through 5 moist, and chroma of 4 through 6 dry and 4 through 8 moist. It is cobbly, very cobbly, or very gravelly clay loam; very cobbly or very gravelly loam; and gravelly, very gravelly, or very cobbly sandy clay loam.

Manila series

The Manila series consists of very deep, well drained soils formed in materials weathered from sandstone and quartzite. Manila soils are on nearly level to moderately steep or gently rolling to rolling high lake terraces and mountain footslopes and on steep or very steep mountainsides. Elevations are 4,900 to 7,000 feet, and slopes range from 0 to 40 percent. The average annual precipitation is about 21 inches, and the mean annual air temperature is about 44 degrees F.

Manila soils are similar to Ostler soils. They are near Ant Flat, Bertag, Crooked Creek, Durfee, and Yeates Hollow soils. Ostler soils have hue of 10YR and 2.5YR in the B2t horizon and formed in materials weathered from tuffaceous rocks. Ant Flat soils have a horizon of lime accumulation at a depth of 10 to 36 inches. Bertag and Crooked Creek soils have a mollic epipedon 20 inches or more thick. Crooked Creek soils lack a B2t horizon and are poorly drained. Durfee and Yeates Hollow soils have more than 35 percent rock fragments in the B2t horizon.

Typical pedon of a Manila loam in an area of Manila loam, 25 to 40 percent slopes, in Morgan County, 1 mile east and 0.4 mile north of East Canyon Dam, 530 feet east and 750 feet south of the northwest corner of section 11, T. 2 N., R. 3 E.:

A11—0 to 9 inches; very dark brown (10YR 2/2) heavy loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and few fine pores; 10 percent gravel; slightly acid (pH 6.1); gradual wavy boundary. (7 to 11 inches thick)

A12—9 to 17 inches; very dark brown (10YR 2/2) clay loam, dark brown (10YR 3/3) dry; weak fine subangular blocky structure; slightly hard, firm, sticky and plastic; many very fine, common fine, few coarse roots; many very fine and few fine and medium pores; 15 percent gravel; slightly acid (pH 6.1); clear wavy boundary. (0 to 10 inches thick)

B21t—17 to 34 inches; brown (7.5YR 4/4) clay, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; hard, very firm, very sticky and very plastic; common very fine roots; many very fine pores; continuous thin clay films on peds; 15 percent gravel; slightly acid (pH 6.1); gradual smooth boundary. (7 to 20 inches thick)

B22t—34 to 50 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; weak coarse prismatic structure parting to moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; continuous thin clay films on peds; 5 percent gravel; slightly acid (pH 6.1); clear wavy boundary. (14 to 26 inches thick)

B3t—50 to 60 inches; dark brown (7.5YR 4/4) heavy clay loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; common thin clay films on peds; 10 percent gravel; slightly acid (pH 6.1).

The mollic epipedon is 11 to 19 inches thick. The combined thickness of the A1 and B2t horizons is 41 to more than 60 inches. Rock fragments consist of gravel and cobbles; content ranges from 0 to 20 percent. Reaction is mainly slightly acid to neutral, but in some pedons it is neutral to moderately alkaline below a depth of 41 inches. The soil is dominantly noncalcareous throughout, but some pedons are slightly to strongly calcareous below a depth of 41 inches.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam, silt loam, or clay loam. The B2t horizon has hue of 10YR, 7.5YR, and 5YR, value of 4 through 6 dry and 2 through 5 moist, and chroma of 2 through 6 dry and moist. It is clay, silty clay, or heavy clay loam. The B2t horizon has hue of 10YR, 7.5YR, or 5YR, and value of 5 or 6 dry and 3 through 5 moist. It is sandy clay loam, loam, or heavy clay loam.

Mondey series

The Mondey series consists of very deep, well drained soils formed in materials weathered mostly from sandstone. Mondey soils are on rolling hills, mountain foot slopes, and mountainsides at elevations of 5,100 to 5,800 feet. Slopes are 8 to 30 percent. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 45 degrees F.

Mondey soils are near Hawkins, Richville, and Stoda soils. Hawkins soils lack a B2t horizon. Richville soils lack a mollic epipedon and a B2t horizon and are 28 to 40 inches deep over tuffaceous sandstone. Stoda soils have a mean annual temperature of more than 47 degrees F and lack a B2t horizon.

Typical pedon of a Mondey clay loam in an area of Mondey clay loam, 15 to 30 percent slopes, approximately 1 1/2 miles west and 2 miles south of Morgan, 1,320 feet west and 5,000 feet north of the east quarter-corner of section 10, T. 3 N., R. 2 E.:

Ap—0 to 4 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, firm, sticky and plastic; few very fine and fine roots; common very fine pores; slightly acid (pH 6.2); clear smooth boundary. (3 to 5 inches thick)

A12—4 to 9 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and common very fine roots; few very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary. (4 to 6 inches thick)

B1t—9 to 14 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; weak medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary. (4 to 6 inches thick)

B21t—14 to 23 inches; reddish brown (5YR 4/3) clay, brown (7.5YR 5/4) dry; moderate medium and coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine pores; common thin clay films on peds and in pores; slightly acid (pH 6.2); clear smooth boundary. (8 to 10 inches thick)

B22t—23 to 31 inches; reddish brown (5YR 4/3) clay; brown (7.5YR 5/4) dry; moderate medium and coarse subangular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine and fine and few medium roots; common very fine and fine pores; common thin clay films on peds and in pores; slightly acid (pH 6.2); clear smooth boundary. (7 to 9 inches thick)

B3ca—31 to 36 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine pores; common thin clay films on peds and in pores; moderately calcareous; veins of lime; neutral (pH 6.8); clear smooth boundary. (0 to 6 inches thick)

Cca—36 to 60 inches; brown (7.5YR 5/4) loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine and fine roots; many very fine and fine pores; strongly calcareous, veins and coatings of lime on blocks; neutral (pH 7.2).

The mollic epipedon is 8 to 19 inches thick. The combined thickness of the A1 and B2t horizons ranges from 22 to 44 inches. The soil cracks to the surface in late summer. Gilgai micro-relief is evident in undisturbed areas. Reaction is slightly acid or neutral in the A1 and B2t horizons, and neutral to moderately alkaline in the Cca horizon. The Cca horizon is strongly calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry and 2 moist, and chroma of 2 or 3 dry and 2 moist. It is clay loam or silty clay loam. The B2t horizon has hue of 7.5YR or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 through 4 dry and moist. It is clay or silty clay. The Cca horizon has hue of 10YR or 7.5YR, value of 6 through 8 dry and 4 through 7 moist, and chroma of 2 or 3 dry and 2 through 4 moist. It is loam, clay loam, or silt loam.

Morgala series

The Morgala series consists of very deep, well drained soils formed in materials weathered mostly from sandstone. Morgala soils are on very steep mountainsides at elevations of 5,450 to 7,000 feet. Slopes are 30 to 60 percent. Average annual precipitation is about 22 inches, and the mean annual air temperature is about 45 degrees F.

Morgala soils are near Ercan, Flygare, Norcan, and Poleline soils. All of these soils have a mollic epipedon. Ercan and Flygare soils have an A2 horizon. Flygare and Poleline soils have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches.

Typical pedon of Morgala loam in an area of Morgala loam, 30 to 60 percent slopes, about 4 miles south and 3 1/2 miles west of Porterville, 1,600 feet west and 2,100 feet south of the northeast corner of section 8, T. 2 N., R. 2 E.:

O1—1 inch to 0; matted leaves and twigs. (0 to 1 inch thick)

A1—0 to 4 inches; dark reddish brown (5YR 3/2) heavy loam, reddish brown (5YR 4/4) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; neutral reaction (pH 7.2); abrupt smooth boundary. (4 to 15 inches thick)

B21t—4 to 13 inches; dark reddish brown (2.5YR 3/4) heavy silty clay loam, red (2.5YR 4/6) dry; moderate medium prismatic structure parting to strong medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; common very fine and fine pores; continuous thin clay films on peds; 15 percent cobbles; neutral (pH 7.2); gradual wavy boundary. (7 to 17 inches thick)

B22t—13 to 29 inches; dark red (2.5YR 3/6) heavy silty clay loam, red (2.5YR 4/6) dry; weak medium prismatic structure parting to strong medium subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine and medium roots; many very fine and fine pores; continuous thin clay films on peds; 15 percent cobbles; neutral reaction (pH 7.2); gradual irregular boundary. (0 to 25 inches thick)

B23t—29 to 39 inches; dark red (2.5YR 3/6) heavy silty clay loam, red (2.5YR 4/6) dry; moderate medium and coarse subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine roots; many very fine and fine pores; continuous thin clay films on peds; 10 percent cobbles and 5 percent gravel; moderately calcareous; moderately alkaline (pH 8.0); gradual irregular boundary. (10 to 20 inches thick)

B3t—39 to 60 inches; dark red (2.5YR 3/6) gravelly silty clay loam, red (2.5YR 4/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; common thin clay films on peds; 5 percent cobbles and 20 percent gravel; strongly calcareous; moderately alkaline (pH 8.0).

Morgala soils have an ochric epipedon. The combined thickness of the A1, B2t, and B3t horizons is 60 inches or more. Rock fragments are rounded sandstone gravel and cobbles; they make up 0 to 20 percent of the A1 horizon and the upper part of the B2t horizon and 0 to 25 percent of the lower part of the B2t and the B3t horizon. Reaction is neutral to mildly alkaline in the A1 horizon, neutral to moderately alkaline in the B2t horizon and moderately to strongly alkaline in the B3t horizon. The upper 25 to 44 inches of the soil is noncalcareous, and below this it is moderately to strongly calcareous.

The A1 horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 or 5 dry and 3 moist, and chroma of 2 through 6 dry and moist. It is loam or silty clay loam. The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 8 dry and 4 through 6 moist. It is heavy silty clay loam or heavy clay loam or clay. The B3t horizon has hue of 2.5YR or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 8 dry and 6 moist. It is gravelly silty clay loam, gravelly clay loam, silty clay loam, clay loam, or clay.

Moweba series

The Moweba series consists of very deep, well drained soils formed in materials weathered mostly from a conglomerate of quartzite and sandstone. Moweba soils are on north- and east-facing mountainsides and alluvial fans at elevations of 5,500 to 8,000 feet. The slopes range from 6 to 50 percent. Average annual precipitation is about 22 inches, and the mean annual temperature is about 43 degrees F.

Moweba soils are similar to Burgi and Lamondi soils. They are near Charcol, Lucky Star, St. Marys, and Durfee soils. Burgi soils have more than 75 percent base saturation in all parts above a depth of 30 inches. Lamondi soils have hue of 10YR in the upper part of the B2 horizon and are no redder than 7.5YR in any other part. They formed in materials weathered from argillite, phyllite, and schist. Charcol and Lucky Star soils have A2 and B2t horizons and have a cooler summer temperature. Lucky Star and St. Marys soils have a mollic epipedon less than 20 inches thick. Durfee soils have more than 35 percent clay in the B2t horizon and a mollic epipedon less than 20 inches thick.

A typical pedon of Moweba gravelly loam in an area of Moweba-St. Marys complex, 30 to 50 percent slopes, about 3 miles north and 6 miles east of Croydon, 2,000 feet west and 200 feet north of the southeast corner of section 4, T. 4 N., R. 5 E.:

A11—0 to 5 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (7.5YR 3/2) dry; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 30 percent gravel; neutral (pH 6.8); clear smooth boundary. (3 to 15 inches thick)

A12—5 to 16 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (7.5YR 3/2) dry; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 30 percent gravel; neutral (pH 6.8); clear smooth boundary. (6 to 19 inches thick)

A13—16 to 30 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (7.5YR 3/2) dry; weak medium subangular blocky structure parting to weak coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few very fine and fine pores; 25 percent gravel, 5 percent cobbles; neutral (pH 6.6); abrupt irregular boundary. (0 to 15 inches thick)

B21—30 to 45 inches; brown (7.5YR 4/4) very gravelly loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine and fine pores; 10 percent cobbles and 45 percent gravel; neutral (pH 7.0); diffuse smooth boundary. (6 to 22 inches thick)

B22—45 to 65 inches; brown (7.5YR 4/4) very gravelly loam, strong brown (7.5YR 5/6) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and fine pores; 10 percent cobbles and 40 percent gravel; slightly acid (pH 6.4).

The mollic epipedon is 20 to 34 inches thick. Combined thickness of the A and B2 horizons ranges from 30 to more than 60 inches. Rock fragments consist of rounded cobbles and gravel and make up 20 to 35 percent of the A1 horizon and 35 to 70 percent of the B2 horizon. The average rock fragment content is 35 to 50 percent in the layer between depths of 10 and 40 inches. The base saturation is 75 percent or less in some parts or in all of the upper 30 inches. Reaction is generally medium acid to neutral, but some pedons have a C horizon that is medium acid to mildly alkaline.

The A1 horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is gravelly loam, loam, or gravelly silt loam. The B2 horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 through 6 dry and 4 or 5 moist, and chroma of 3 through 8 dry and 4 through 8 moist. It is a very gravelly, gravelly, cobbly, or very cobbly loam or very gravelly silt loam. The C horizon, where present, has hue of 7.5YR, 5YR or 2.5YR, value of 4 through 6 dry and 3 or 4 moist, and chroma of 4 through 6 dry and moist. It is very gravelly fine sandy loam, very gravelly sandy loam, cobbly sandy loam, very gravelly loamy fine sand, very gravelly loamy sand, or very gravelly loam.

Nagitsy series

The Nagitsy series consists of moderately deep, well drained soils formed in materials weathered from quartzite, schist, argillite, phyllite, or gneiss. Nagitsy soils are on southeast-facing high mountainsides and subalpine side slopes at elevations of 6,400 to 9,800 feet. The average annual precipitation is about 40 inches, and the mean annual air temperature is about 39 degrees F.

Nagitsy soils are similar to Caballo and Poleline soils. They are near Broad Canyon, Foxol, Moweba, and Patio soils. Poleline, Broad Canyon, and Moweba soils all are deep or very deep with bedrock at a depth of 40 to more than 60 inches. Broad Canyon soils have a mollic epipedon 10 to 16 inches thick. Foxol soils have bedrock at a depth of 14 to 20 inches. Patio soils have summer soil temperatures of 60 to 66 degrees F.

A representative pedon of Nagitsy stony loam, in an area of Nagitsy-Rock outcrop complex, 50 to 70 percent slopes, in a noncultivated area in Morgan County, 1 1/2 miles north of Francis Peak, 3,600 feet north and 1,800 feet west of the southeast corner of section 28, T. 4 N., R. 1 E.:

A11—0 to 9 inches; very dark grayish brown (10YR 2/3) stony loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; 20 percent cobbles, 5 percent stones, and 5 percent gravel; medium acid (ph 5.6); clear wavy boundary. (6 to 10 inches thick)

A12—9 to 15 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; 25 percent gravel and 10 percent cobbles; medium acid (pH 5.6); clear wavy boundary. (6 to 12 inches thick)

C1—15 to 29 inches; very dark grayish brown (10YR 3/2) very gravelly loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; 35 percent gravel and 15 percent cobbles; medium acid (pH 5.6); clear wavy boundary. (7 to 14 inches thick)

C2—29 to 35 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure parting to moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 30 percent gravel and 20 percent cobbles; medium acid (pH 5.6); gradual wavy boundary. (0 to 7 inches thick)

C3—35 to 39 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 25 percent gravel and 15 percent cobbles; medium acid (pH 5.6); abrupt irregular boundary. (0 to 4 inches thick)

R—39 inches; fractured bedrock.

The mollic epipedon is 17 to 39 inches thick. The bedrock occurs at a depth of 23 to 39 inches. Rock fragments consist of stones, cobbles, and gravel and make up 30 to 45 percent of the A horizon and 45 to 70 percent of the C horizon. Reaction is medium acid or slightly acid in the A1 horizon and medium acid in the C horizon.

The A1 horizon has hue of 10YR and 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is stony, gravelly, or cobbly loam. Stones are mostly on the surface. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 through 4 dry and moist. It is gravelly, very gravelly, or very cobbly loam, very cobbly sandy loam, or very gravelly clay loam.

Nebeker series

The Nebeker series consists of very deep, well drained soils formed in mixed lake sediments. Nebeker soils are on nearly level and gently rolling terraces at elevations of 4,900 to 5,150 feet. Slopes range from 0 to 6 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Nebeker soils are similar to Henefer, Cristo, and Broadhead soils. They are near Eastcan, Hawkins, Parleys, and Stoda soils. Henefer, Cristo, Hawkins, and Broadhead soils all have mean annual soil temperatures of less than 47 degrees F. Cristo soils have bedrock at a depth of 20 to 35 inches. Eastcan soils lack a B2t horizon and have less than 35 percent clay between depths of 10 and 40 inches. Hawkins soils lack a B2t horizon and crack to the surface in late summer. Parleys soils have a mollic epipedon less than 20 inches thick, have less than 35 percent clay in the B2t horizon, and have horizons of carbonate accumulation. Stoda soils are calcareous throughout, lack a B2t horizon, and have less than 35 percent clay between depths of 10 and 40 inches.

Typical pedon of Nebeker clay loam in an area of Nebeker clay loam, 0 to 3 percent slopes, in Morgan County, 1 mile south of Milton, 1,250 feet west and 300 feet south of the northeast corner of section 22, T. 4 N., R. 2 E.:

Ap1—0 to 3 inches; very dark brown (10YR 2/2) clay loam, dark brown (10YR 4/3) dry; weak coarse subangular blocky structure parting to strong medium granular structure; hard, firm, sticky and plastic; many very fine, fine, medium, and coarse roots; slightly acid (pH 6.2); abrupt smooth boundary. (3 to 9 inches thick)

Ap2—3 to 8 inches; very dark brown (10YR 2/2) clay loam, dark brown (10YR 4/3) dry; weak coarse subangular blocky structure parting to strong medium granular structure; hard, firm, sticky and plastic; common very fine, fine, medium, and coarse roots; slightly acid (pH 6.2); clear smooth boundary. (0 to 5 inches thick)

A13—8 to 13 inches; very dark brown (10YR 2/2) clay loam, dark brown (10YR 4/3) dry; weak medium and coarse subangular blocky structure parting to moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; few very fine pores; 5 percent fine gravel; slightly acid (pH 6.2); clear smooth boundary. (0 to 11 inches thick)

B1t—13 to 20 inches; very dark grayish brown (10YR 3/2) clay loam, dark brown (10YR 4/3) dry; weak medium and coarse subangular blocky structure parting to moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine pores; very few thin clay films on peds; slightly acid (pH 6.2); gradual smooth boundary. (0 to 7 inches thick)

B21t—20 to 32 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; weak medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine pores; many thin and few moderately thick clay films on peds; slightly acid (pH 6.2); clear smooth boundary. (6 to 25 inches thick)

B22t—32 to 47 inches; reddish brown (5YR 4/4) clay, yellowish red (5YR 5/6) dry; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; many thin and common moderately thick clay films on peds; slightly acid (pH 6.2); abrupt wavy boundary. (0 to 16 inches thick)

B23t—47 to 55 inches; yellowish red (5YR 4/6) heavy sandy clay loam, yellowish red (5YR 5/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few thin clay films on peds; slightly acid (pH 6.2); abrupt smooth boundary. (0 to 20 inches thick)

B24t—55 to 60 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few very fine pores; common thin clay films on peds; slightly acid (pH 6.2); abrupt smooth boundary. (0 to 5 inches thick)

B3tca—60 to 69 inches; yellowish red (5YR 5/6) clay loam, reddish yellow (5YR 6/6) dry; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine pores; common thin and few moderately thick clay films on peds; moderately calcareous; bands of lime; moderately alkaline (pH 8.0).

The mollic epipedon is 33 to more than 60 inches thick. The combined thickness of the A1 and B2t horizons is 36 to more than 60 inches. The texture in the upper 20 inches of the B2t horizon is clay, silty clay, or clay loam with more than 35 percent clay. Reaction is slightly acid to neutral in the A1 and B2t horizons. Some pedons have a horizon of lime accumulation at a depth of 40 to more than 60 inches. This horizon is moderately alkaline to strongly alkaline and moderately to strongly calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is clay loam, silty clay loam, loam, or silt loam. The B2t horizon has hue of 7.5YR or 5YR, value of 3 through 5 dry and 2 through 4 moist, and chroma of 2 through 6 dry and moist. It is clay, silty clay, heavy silty clay loam, or clay loam. In some pedons that have a Cca horizon below a depth of about 36 inches, the texture is clay loam, sandy clay loam, silt, silt loam, loam, very fine or fine sandy loam, or sandy loam.

Nicodemus series

The Nicodemus series consists of very deep, moderately well drained soils formed in alluvium weathered from argillite, phyllite, schist, and some quartzite. Nicodemus soils are on nearly level and gently sloping flood plains or stream terraces at elevations of 4,900 to 5,350 feet. Slopes range from 0 to 3 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 46 degrees F.

Nicodemus soils are similar to Lamondi and Moweba soils. They are near Crooked Creek and Trojan soils. Lamondi and Moweba soils have an average annual soil temperature of less than 47 degrees F. Crooked Creek soils have less than 35 percent rock fragments and more than 35 percent clay in the layer between depths of 10 and 40 inches. Crooked Creek soils are poorly drained and have seasonal high water table at a depth of 0 to 20 inches. Trojan soils have a mollic epipedon less than 20 inches thick and have a B2t horizon that is less than 35 percent rock fragments.

Typical pedon of Nicodemus gravelly loam in an area of Nicodemus gravelly loam, 0 to 3 percent slopes, in Weber County, 3/4 mile north of Liberty, 900 feet west and 400 feet north of east quarter-corner of section 17, T. 7 N., R. 1 E.:

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; 25 percent gravel, slightly acid (pH 6.3); clear wavy boundary. (4 to 10 inches thick)

A12—8 to 17 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, brown (10YR 4/3) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few fine pores; 25 percent gravel and 5 percent cobbles, slightly acid (pH 6.1); clear wavy boundary. (0 to 12 inches thick)

A13—17 to 22 inches; dark brown (10YR 3/3) cobbly clay loam, brown (10YR 4/3) dry; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine and fine roots; few fine pores; 30 percent cobbles and 20 percent gravel; slightly acid (pH 6.1); clear wavy boundary. (0 to 5 inches thick)

IIC—22 to 60 inches; very dark grayish brown (2.5Y 3/2) very gravelly loamy sand, light olive brown (2.5Y 5/4) dry; single grained; loose; few very fine and fine roots; 45 percent gravel and 25 percent cobbles; slightly acid (pH 6.1).

The mollic epipedon is 20 to 29 inches thick. Some pedons have horizons with dark colors below these depths, but the organic-matter content is less than 1 percent. The layer between depths of 10 and 40 inches is mainly gravelly or very cobbly clay loam or loam but ranges to very gravelly loamy sand in the lower part. Rock fragments average 35 to 65 percent in the layer between depths of 10 and 40 inches. Rock fragments consist of gravel and cobbles; they make up 20 to 50 percent of the A1 horizon and 50 to 75 percent of the IIC horizon. Depth to seasonal high water table ranges from 24 to 48 inches. Reaction is slightly acid to neutral in the A1 horizon and medium acid to slightly acid in the IIC horizon.

The A1 horizon has hue of 10YR, value of 3 through 5 dry and and 2 or 3 moist, and chroma of 2 or 3 dry and moist. It is gravelly loam in the surface layer and gravelly clay loam, loam, coarse sandy loam, or cobbly or very cobbly loam in the lower part of the A1 horizon. The IIC horizon has hue of 10YR or 2.5Y, value of 3 through 5 dry and 3 or 4 moist, and chroma of 2 through 4 dry and 2 or 3 moist. Many medium or

coarse prominent yellowish red (5YR 4/6) mottles occur in some pedons. The IIC horizon is stratified very gravelly or gravelly loam, sandy loam, loamy sand, loamy coarse sand, or coarse sand.

Norcan series

The Norcan series consists of very deep, well drained soils formed mostly in materials weathered from sandstone. Norcan soils are on very steep mountainsides at elevations of 5,200 to 7,500 feet. The slopes range from 30 to 60 percent and are dominantly north and east facing. Average annual precipitation is about 20 inches, and the mean annual air temperature is about 43 degrees F.

Norcan soils are near Ercan, Hawkins, Henhoit, Hoskin, Morgala, Moweba, Nordic, and Ostler soils. Ercan and Nordic soils have an A2 horizon, have less than 35 percent rock fragments in the B2t horizon, and are more than 24 inches deep to the upper boundary of the B2t horizon. Hawkins soils lack a B2t horizon and crack to the surface in late summer. Henhoit and Hoskin soils have less than 35 percent clay and more than 35 percent rock fragments in the B2t horizon. Hoskin soils have bedrock at a depth of 20 to 40 inches. Morgala soils lack a mollic epipedon. Moweba soils have a mollic epipedon more than 20 inches thick, lack a B2t horizon, and are less than 35 percent clay and more than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Ostler soils have hue of 10YR and 2.5Y in the B2t horizon.

Typical pedon of Norcan loam, in an area of Norcan loam, 30 to 60 percent slopes, about 5 miles southwest of Morgan, 2,400 feet west and 800 feet north of the southeast corner of section 17, T. 3 N., R. 2 E.:

O1—1 inch to 0; leaves and stems. (1 to 2 inches thick)

A11—0 to 4 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; neutral (pH 7.3); clear smooth boundary. (3 to 11 inches thick)

A12—4 to 15 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/3) dry; weak coarse subangular blocky structure parting to moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, and coarse roots; neutral (pH 7.3); clear smooth boundary. (0 to 13 inches thick)

B21t—15 to 21 inches; dark reddish brown (5YR 3/4) heavy clay loam, reddish brown (5YR 4/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine, fine, and medium and few coarse roots; few very fine pores; few thin clay films on peds; neutral (pH 7.3); clear smooth boundary. (6 to 17 inches thick)

B22t—21 to 44 inches; dark red (2.5YR 3/6) clay, red (2.5YR 4/6) dry; moderate coarse prismatic structure parting to moderate coarse subangular blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; few thin clay films on peds; neutral (pH 7.3); gradual smooth boundary. (12 to 23 inches thick)

B23t—44 to 60 inches; dark red (2.5YR 3/6) heavy silty clay loam, red (2.5YR 5/6) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; few very fine roots; few thin clay films on peds; neutral (pH 7.3).

The mollic epipedon is 11 to 19 inches thick. The combined thickness of the A and B2t horizons is more than 60 inches. Rock fragments consist of angular sandstone gravel and make up 0 to 10 percent. Reaction is slightly acid or neutral.

The A1 horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 8 dry and moist. It is clay loam, clay, or heavy silty clay loam.

Nordic series

The Nordic series consists of very deep, well drained soils formed in materials weathered from argillite, phyllite, and schist. Nordic soils are on north- and east-facing mountainsides at elevations of 5,200 to 7,000 feet. Slopes are 30 to 60 percent. Average annual precipitation is about 30 inches, and the mean annual soil temperature is about 44 degrees F.

Nordic soils are similar to Lucky Star and Schuster soils. They are near Lamondi and Patio soils. Lucky Star soils have a mixed A and B horizon and have hue of 5YR or redder in at least part of the B2t horizon. Schuster soils have hue of 5YR or 2.5YR in the B2t horizon, and the upper boundary of the B2t horizon is above a depth of 40 inches. Lamondi soils have a mollic epipedon more than 20 inches thick and lack both A2 and B2t horizons. Patio soils lack a B2t horizon and are 20 to 40 inches deep to bedrock.

Typical pedon of Nordic gravelly loam in an area of Nordic gravelly loam, 30 to 60 percent slopes, near Nordic Valley ski lift, 170 feet west and 2,000 feet south of the north quarter-corner of section 32, T. 7 N., R. 1 E.:

O1—1 inch to 0; leaves, twigs, etc.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and few medium and coarse roots; 20 percent gravel; slightly acid (pH 6.1); clear wavy boundary. (6 to 7 inches thick)

A12—6 to 15 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; 25 percent gravel; slightly acid (pH 6.1); gradual irregular boundary. (9 to 13 inches thick)

A21—15 to 24 inches; dark yellowish brown (10YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium and coarse subangular blocky structure parting to weak coarse granular structure; slightly hard, friable, slightly sticky and plastic; common fine and few medium roots; many fine and very fine pores; 35 percent gravel; slightly acid (pH 6.1); gradual wavy boundary. (9 to 21 inches thick)

A22—24 to 40 inches; dark yellowish brown (10YR 4/5) gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine and very fine pores; 30 percent gravel, 10 percent cobbles; slightly acid (pH 6.2); gradual wavy boundary. (0 to 17 inches thick)

B21t—40 to 47 inches; strong brown (7.5YR 5/6) gravelly clay loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many very fine and fine pores; 35 percent gravel, 5 percent cobbles; slightly acid (pH 6.2); gradual irregular boundary. (7 to 16 inches thick)

B22t—47 to 58 inches; strong brown (7.5YR 5/6) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; 40 percent gravel, 20 percent cobbles, 5 percent stones; slightly acid (pH 6.1); clear wavy boundary. (0 to more than 13 inches thick)

C—58 to 70 inches; brown (7.5YR 5/4) very cobbly loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 25 percent gravel, 45 percent cobbles; slightly acid (pH 6.1).

The mollic epipedon is 15 to 19 inches thick. Depth to the upper boundary of the B2t horizon ranges from 40 to 45 inches. The combined thickness of the A1, A2, and B2t horizons is 55 to more than 60 inches over the C horizon. Rock fragments consist of angular gravel, cobbles, and stones; they make up 20 to 25 percent of the A1 horizon, 35 to 55 percent of the A2 horizon, and 50 to 65 percent of the B2t horizon. The layer between depths of 10 and 40 inches ranges from 35 to 55 percent rock fragments. Reaction is dominantly slightly acid but may range to medium acid in the B2t horizon.

The A1 horizon has hue of 10YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. The A2 horizon has hue of 10YR or 7.5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 4 through 6 dry and moist. It is gravelly loam or gravelly or very gravelly clay loam. The B2t horizon has hue of 10YR or 7.5YR, value of 6 dry and 4 or 5 moist, and chroma of 4 through 6 dry and moist. It is gravelly or very gravelly clay loam with less than 35 percent clay. The C horizon has hue of 7.5YR or 10YR, value of 6 dry and 5 moist, and chroma of 4 dry and moist. It is very cobbly or very gravelly loam.

Ostler series

The Ostler series consists of very deep, well drained soils that formed in materials weathered from tuffaceous sandstone, tuffaceous siltstone, and tuffaceous limestone. They are on foothills on all aspects at elevations of 5,200 to 6,700 feet. Slopes range from 20 to 50 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

Ostler soils are similar to Manila soils. They are near Causey, Hawkins, and Manila soils. Manila soils have hue of 7.5YR and 5YR in the B2t horizon. Causey soils have less than 35 percent clay in the layer between depths of 10 and 40 inches, lack a B2t horizon, and have an accumulation of calcium carbonate. Hawkins soils lack a B2t horizon and have wide cracks during late summer.

Typical pedon of an Ostler loam in an area of Ostler loam, 20 to 50 percent slopes, about 3 miles southwest of Huntsville, 600 feet east and 900 feet north of the southwest corner of section 23, T. 6 N., R. 1 E.:

O1—1 inch to 0; matted decaying leaves and twigs.

A11—0 to 7 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; common fine and medium and coarse roots; slightly acid (pH 6.1); clear smooth boundary. (2 to 18 inches thick)

A12—7 to 18 inches; very dark brown (10YR 2/2) loam; dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure parting to moderate fine and medium granular; hard, friable, sticky and plastic; common fine and medium and coarse roots; slightly acid (pH 6.2); clear wavy boundary. (0 to 12 inches thick)

B21t—18 to 22 inches; dark brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and very plastic; few fine, medium, and coarse roots; common fine pores; common thin clay films on peds; medium acid (pH 5.8); gradual wavy boundary. (4 to 16 inches thick)

B22t—22 to 28 inches; light olive brown (2.5Y 5/3) clay, light gray (2.5Y 7/2) dry; moderate medium and coarse subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; many very fine and fine pores; common thin clay films on peds; medium acid (pH 5.6); gradual irregular boundary. (6 to 22 inches thick)

B23t—28 to 37 inches; dark brown (10YR 4/3) heavy clay loam, light gray (10YR 7/2) dry; moderate medium and coarse subangular blocky structure; extremely hard, very firm, sticky and very plastic; few fine, medium, and coarse roots; many fine and very fine pores; many thin clay films on peds; medium acid (pH 5.6); gradual irregular boundary. (0 to 16 inches thick)

B24t—37 to 49 inches; dark yellowish brown (10YR 5/8) sandy clay loam; light brownish gray (10YR 6/2) dry; common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; extremely hard, very firm, slightly sticky and very plastic; few fine and medium roots; many fine and very fine pores; few thin clay films on peds; medium acid (pH 5.8) gradual wavy boundary. (0 to 22 inches thick)

C—49 to 60 inches; light brownish gray (2.5YR 6/2) heavy clay loam, light gray (2.5Y 7/2) dry crushed; aggregate color is 50 percent dark grayish brown (10YR 4/2) moist and 50 percent pale olive (5Y 6/3) moist; weak coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; many very fine and fine pores; medium acid (pH 5.8).

The mollic epipedon is 10 to 20 inches thick. The combined thickness of the A1 and B2t horizons is 35 to more than 60 inches; rock fragments are gravel and range from 0 to 20 percent in the C horizon. Reaction is slightly acid to neutral in the A1 horizon, medium acid to neutral in the B2t horizon and medium acid to strongly alkaline in the C horizon. The C horizon is noncalcareous to strongly calcareous.

The A1 horizon has hue of 10YR, value of 4 dry and 2 or 3 moist, and chroma of 1 or 2 dry and moist. It is loam in the upper part and clay loam or silty clay loam in the lower part. The B2t horizon has hue of 10YR or 2.5Y, value of 4 through 7 dry and 3 through 5 moist, and chroma of 2 through 4 dry and moist. It is clay loam, clay, sandy clay loam, silty clay, or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 6 through 8 dry and 4 through 6 moist, and chroma of 2 or 3 dry and 2 through 4 moist. It is a clay loam, loam, silt loam, sandy clay loam, silty clay loam, or gravelly clay loam.

Parleys series

The Parleys series consists of very deep, well drained soils formed in lake sediments and alluvium. Parleys soils are on nearly level or gently sloping lake terraces, stream terraces, and alluvial fans at elevations of 4,900 to 5,150 feet. Slopes are 0 to 3 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 46 degrees F.

Parleys soils are similar to Parlo soils. They are near Eastcan, Phoebe, Steed, and Stoda soils. Parlo soils have a very gravelly sand layer below a depth of 31 to 36 inches. Eastcan, Phoebe, Steed, and Stoda soils all lack a B2t horizon. Eastcan soils have a mollic epipedon more than 20 inches thick. Phoebe soils are noncalcareous throughout and have less than 18 percent clay in the layer between depths of 10 and 40 inches. Steed soils have more than 35 percent rock fragments and less than 18 percent clay in the layer between depths of 10 and 40 inches. Stoda soils lack a B2t horizon and are calcareous throughout.

Typical pedon of Parleys loam in an area of Parleys loam, high rainfall, 0 to 3 percent slopes, in Morgan County, 2 1/2 miles west of Morgan City and County Memorial Building, 1,350 feet west and 2,200 feet south of the northeast corner of section 33, T. 4 N., R. 2 E.:

Ap1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; moderate thin and medium platy structure;

slightly hard, friable, nonsticky and slightly plastic; common very fine, fine, and medium roots; few fine pores; slightly acid (pH 6.4); abrupt smooth boundary. (3 to 10 inches thick)

Ap2—3 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine, fine, and medium roots; few fine pores; slightly acid (pH 6.2); abrupt smooth boundary. (4 to 11 inches thick)

A13—7 to 13 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and slightly plastic; common very fine, fine, and medium roots, few fine pores; slightly acid (pH 6.2); clear wavy boundary. (0 to 6 inches thick)

B21t—13 to 18 inches; very dark brown (10YR 3/3) silty clay loam, dark brown (10YR 4/3) dry; moderate medium prismatic structure parting to moderate fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; few fine pores; common thin clay films on peds; slightly acid (pH 6.2); clear wavy boundary. (5 to 21 inches thick)

B22t—18 to 32 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; moderate medium prismatic structure parting to strong fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; few fine pores; many thin and few moderately thick clay films on peds; slightly acid (pH 6.2); abrupt wavy boundary. (0 to 14 inches thick)

B3tca—32 to 37 inches; dark brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; weak coarse subangular blocky structure parting to strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; few thin clay films on peds; strongly calcareous; moderately alkaline (pH 8.0); clear wavy boundary. (0 to 6 inches thick)

C1ca—37 to 45 inches; brown (7.5YR 5/4) silty clay loam, light brown (7.5YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; strongly calcareous; masses and veins of lime; moderately alkaline (pH 8.4); clear smooth boundary. (8 to 10 inches thick)

C2ca—45 to 57 inches; brown (7.5YR 5/4) loam, pink (7.5YR 7/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few fine pores; strongly calcareous; masses and veins of lime; moderately alkaline (pH 8.4); abrupt wavy boundary. (8 to 18 inches thick)

C3ca—57 to 60 inches; strong brown (7.5YR 5/6) loam with pockets of very fine sand, light brown (7.5YR 6/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many fine pores; strongly calcareous; masses of lime; moderately alkaline (pH 8.4).

The mollic epipedon is 14 to 19 inches thick. The combined thickness of the A1 and B2t horizons is 29 to 40 inches. Reaction is slightly acid to neutral in the A1 and B2t horizons and mildly or moderately alkaline in the Cca horizon. The Cca horizon is strongly calcareous or very strongly calcareous.

The A1 horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. It is loam, silt loam, or clay loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 through 6. It is clay loam or silty clay loam. Texture of individual strata in the Cca horizon is silty clay loam, silt loam, loam, fine sandy loam, or very fine sandy loam.

Parlo series

The Parlo series consists of very deep, well drained soils formed in alluvium weathered from sandstone, quartzite, and limestone. Parlo soils are on nearly level and gently sloping stream terraces at elevations of 5,000 to 5,100 feet. Slopes are 0 to 3 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Parlo soils are similar to Parleys soils. They are near Eastcan, Redola, and Steed soils. All of these soils lack contrasting texture changes to very gravelly loamy sand above depth of 40 inches. Eastcan soils have a mollic epipedon more than 20 inches thick and lack B2t and Cca horizons. Redola and Steed soils both lack a B2t horizon. Redola soils have less than 18 percent clay in the layer between depths of 10 and 40 inches. Steed soils have very gravelly sand through most of the layer between depths of 10 and 40 inches.

Typical pedon of Parlo loam in an area of Parlo loam, 0 to 3 percent slopes, in Morgan County, in the west portion of Morgan City, 1 block north and 1 1/2 blocks west of Morgan County Courthouse, section 35, T. 4 N., R. 2 E.:

A11—0 to 2 inches; very dark brown (10YR 2/2) loam, brown (10YR 4/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; neutral (pH 7.0); abrupt smooth boundary. (2 to 12 inches thick)

A12—2 to 7 inches; dark brown (7.5YR 3/2) loam, brown (10YR 4/3); dry; weak medium subangular blocky structure parting to weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; neutral (pH 7.0); clear smooth boundary. (0 to 6 inches thick)

A13—7 to 15 inches; dark brown (7.5YR 3/2) loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine pores; common fine and very fine and few medium roots; neutral (pH 7.0); gradual wavy boundary. (0 to 8 inches thick)

B1—15 to 19 inches; dark brown (7.5YR 3/2) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine pores; few fine and medium roots; neutral (pH 7.0); gradual wavy boundary. (0 to 4 inches thick)

B2t—19 to 31 inches; dark brown (7.5YR 4/4) heavy loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine pores; few fine and very fine roots; thin continuous clay films on peds; neutral (pH 7.2); abrupt wavy boundary. (11 to 24 inches thick)

Cca—31 to 36 inches; brown (7.5YR 5/4) gravelly loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine pores; few fine and very fine roots; 40 percent gravel; moderately calcareous; veins of lime; neutral (pH 7.2); abrupt wavy boundary. (0 to 8 inches thick)

IIC2—36 to 70 inches; reddish brown (5YR 5/4) very gravelly loamy sand, light brown (7.5YR 6/4) dry; single grained; loose; 70 percent gravel and cobbles; strongly calcareous; moderately alkaline, (pH 8.0).

The mollic epipedon is 12 to 19 inches thick. The combined thickness of the A1 and B2t horizons and the depth to the horizon of lime accumulation is 31 to 36 inches. The depth to the very gravelly sand or loamy sand is 30 to 40 inches. Rock fragment consists of rounded gravel and cobbles; they make up 0 to 20 percent of the A1 and B2t horizons, 35 to 80 percent of the Cca horizon, and 50 to 80 percent of the IIC horizon. Reaction is neutral to mildly alkaline in the A1, B2t, and Cca horizons and mildly alkaline to moderately alkaline in the IIC horizon. The Cca and IIC horizons are moderately calcareous or strongly calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 dry and 2 or 3 moist, and chroma of 3 dry and 2 moist. It is loam or clay loam. The B2t horizon has hue of 7.5YR or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 dry and moist. It is loam or clay loam. The Cca horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 2 through 4. It is gravelly loam or very gravelly sandy clay loam. The IIC horizon is very gravelly sand or loamy sand.

Patio series

The Patio series consists of moderately deep, well drained soils formed in material weathered from phyllite, schist, or argillite. Patio soils are on dominantly south-, east-, and west-facing mountainsides at elevations of 5,200 to 7,000 feet. Slopes range from 40 to 60 percent. The average annual precipitation is about 22 inches, and mean annual temperature is about 44 degrees F.

Patio soils are similar to St. Marys soils. They are near Durfee, Lamondi, Nordic, and Poleline soils. All of these soils are more than 40 inches deep. St. Marys soils have more than 75 percent base saturation throughout the upper 30 inches. Durfee and Nordic soils have a B2t horizon. Lamondi soils have a mollic epipedon more than 20 inches thick.

Typical pedon of Patio gravelly loam in an area of Patio gravelly loam, 40 to 60 percent slopes, about 1/2 mile south and 1 mile west of Utaba Dam, 1,000 feet east and 500 feet north of the southwest corner of section 35, T. 8 N., R. 1 W.:

O1—1 inch to 0; decaying leaves, twigs, etc., about 60 percent of surface covered.

A11—0 to 9 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (10YR 3/3) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 40 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (4 to 9 inches thick)

A12—9 to 13 inches; dark brown (10YR 3/4) gravelly loam, brown (10YR 4/3) dry; weak fine and medium subangular blocky structure parting to weak fine and medium granular structure; slightly hard, friable, slightly sticky and plastic; many very fine and fine and few medium and coarse roots; 40 percent gravel; slightly acid (pH 6.2); clear wavy boundary. (0 to 8 inches thick)

B2—13 to 26 inches; dark yellowish brown (10YR 4/4) very gravelly clay loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine, meidum, and coarse roots; common very fine and fine pores; 55 percent gravel; slightly acid (pH 6.2); abrupt irregular boundary. (10 to 24 inches thick)

R—26 inches; fractured argillite and phyllite.

The mollic epipedon is 8 to 13 inches thick. Depth to bedrock is 20 to 35 inches. Base saturation is less than 75 percent in some part of the upper 30 inches or above bedrock. Rock fragments consist of angular argillite, phyllite and schist gravel and cobbles; they make up 20 to 40 percent of the A1 horizon and 55 to 70 percent of the B2 horizon. Reaction is slightly acid to neutral in the A1 horizon and slightly acid to medium acid in the B2 horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 3 dry and 2 or 3 moist. The B2 horizon has hue of 7.5YR, 10YR, or 2.5YR, value of 5 or 6 dry and 4 moist, and chroma of 3 or 4 dry and moist. It is very gravelly clay loam, very cobbly clay loam, or very gravelly loam.

Phoebe series

The Phoebe series consists of very deep, well drained soils formed in alluvium from sandstone, quartzite, and limestone. Phoebe soils are on nearly level terraces at elevations of 4,900 to 5,000 feet. Slopes are 0 to 3 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 46 degrees F.

Phoebe soils are similar to Redola soils. They are near Brownlee, Eastcan, Parleys, and Steed soils. Redola and Eastcan soils have a mollic epipedon more than 20 inches thick. Eastcan soils have more than 18 percent clay in the layer between depths of 10 and 40 inches. Brownlee and Parleys soils have a B2t horizon that has 18 to 35 percent clay. Parleys soils have a horizon of calcium carbonate accumulation at a depth of 20 to 40 inches. Steed soils are very gravelly sand or coarse sand below depths of 14 to 28 inches.

Typical pedon of Phoebe fine sandy loam in an area of Phoebe fine sandy loam, 0 to 3 percent slopes, in Weber County, about 1 mile north of Huntsville Post Office, 1,000 feet east and 350 feet south of the northwest corner of section 7, T. 6 N., R. 2 E.:

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, very dark brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; neutral (pH 6.8); clear smooth boundary. (6 to 8 inches thick)

A12—8 to 16 inches; brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine and few fine and medium pores; neutral (pH 7.0); clear smooth boundary. (7 to 8 inches thick)

A13—16 to 19 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 5/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine, fine and medium pores; neutral (pH 7.8); clear smooth boundary. (3 to 4 inches thick)

B21—19 to 30 inches; brown (7.5YR 4/4) fine sandy loam, reddish yellow (7.5YR 6/6) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; neutral (pH 7.0); clear smooth boundary. (10 to 11 inches thick)

B22—30 to 46 inches; brown (7.5YR 4/4) fine sandy loam, light brown (7.5YR 6/4) dry; common medium distinct reddish brown (5YR 4/3) mottles; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; neutral (pH 6.8); abrupt smooth boundary. (11 to 16 inches thick)

C1—46 to 52 inches; yellowish red (5YR 5/6) silty clay loam, light reddish brown (5YR 6/4) dry; common medium distinct dark red (2.5YR 3/6) mottles; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; many very fine and common fine and medium pores; varved lake sediments; neutral (pH 6.8); abrupt smooth boundary. (0 to 6 inches thick)

C2—52 to 57 inches; brown (7.5YR 4/4) loamy fine sand, light brown (7.5YR 6/4) dry; single grained; loose; neutral (pH 6.6); abrupt smooth boundary. (5 to 9 inches thick)

C3—57 to 60 inches; brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; common medium distinct yellowish red (5YR 4/6) mottles; massive; very hard, firm, sticky and plastic; many very fine and common fine and medium pores; varved lake sediments; neutral (pH 7.0).

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1 and B2 horizons is 40 to 46 inches. The A1 horizon ranges from 0 to 20 percent gravel. The reaction is slightly acid or neutral.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is fine sandy loam or sandy loam. The B2 horizon has hue of 7.5YR, value of 6 dry and 4 or 5 moist, and chroma of 4 through 6 dry and moist. It is fine sandy loam or loam. The C horizon has hue of 7.5YR or 5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 4 through 6 dry and moist. The C horizon is stratified loamy sand, loamy fine sand, very fine sandy loam, or light silty clay loam. Mottles are common, fine or medium, and distinct dark red (2.5YR 3/6) or yellowish red (5YR 4/6).

Poleline series

The Poleline series consists of deep, well drained soils formed in materials weathered from schist, argillite, phyllite, gneiss, and quartzite. They are on very steep mountainsides and high mountainsides at elevations of 5,200 to 9,000 feet and are dominantly north and east facing. Slopes are 40 to 70 percent. Average annual precipitation is about 30 inches, and the mean annual air temperature is about 41 degrees F.

Poleline soils are similar to Caballo and Nagitsy soils. They are near Flygare, Foxol, Lamondi, Nagitsy, and Patio soils. Caballo soils are slightly or moderately calcareous and mildly alkaline or moderately alkaline in the lower part of the B2 horizon and the C horizon. Nagitsy soils are 20 to 40 inches deep over bedrock. Flygare soils have A2 and B2t horizons. Foxol soils are 14 to 20 inches deep over bedrock. Lamondi soils have summer soil temperatures of more than 59 degrees F. Patio soils have bedrock at a depth of 23 to 32 inches.

Typical pedon of Poleline gravelly loam in an area of Poleline stony loam, 40 to 70 percent slopes, in Weber County, in North Fork Park, about 1,000 feet east and 1,100 feet north of the southwest corner of section 35, T. 8 N., R. 1 W.:

O1—1 inch to 0; matted decaying leaves and twigs.

A11—0 to 4 inches; dark brown (10YR 3/3) stony loam, brown (10YR 4/3) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium and coarse roots; 10 percent gravel, 2 percent stones; slightly acid (pH 6.2); clear smooth boundary. (2 to 5 inches thick)

A12—4 to 8 inches; dark brown (10YR 3/3) gravelly silt loam, brown (10YR 4/3) dry; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 20 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (2 to 5 inches thick)

A13—8 to 20 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 4/3) dry; weak medium subangular blocky structure parting to weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium and coarse roots; 25 percent gravel; medium acid (pH 6.0); clear wavy boundary. (10 to 15 inches thick)

A14—20 to 24 inches; dark brown (7.5YR 3/2) gravelly loam, yellowish brown (10YR 5/4) dry; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and very fine roots; common very fine and fine pores; 30 percent gravel; medium acid (pH 6.0); gradual wavy boundary. (0 to 10 inches thick)

B21—24 to 36 inches; dark brown (7.5YR 3/4) very gravelly loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and fine pores; 15 percent cobbles, 40 percent gravel; medium acid (pH 6.0); gradual wavy boundary. (10 to 16 inches thick)

B22—36 to 48 inches; dark yellowish brown (10YR 4/4) very gravelly loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; many fine and very fine pores; 10 percent cobbles, 50 percent gravel; medium acid (pH 6.0); diffuse irregular boundary. (6 to 12 inches thick)

R—48 inches; fractured phyllite bedrock.

The mollic epipedon is 17 to 33 inches thick. The combined thickness of the A1 and B2 horizons is 42 to more than 60 inches, and depth to bedrock is 48 to more than 60 inches. Rock fragments consist of angular gravel, cobbles, and stones; they make up 15 to 50 percent of the A1 horizon, 25 to 70 percent of the B2 horizon, 50 to 80 percent of the C horizon, and 35 to 60 percent of the layer between depths of 10 and 40 inches. Reaction is medium acid or slightly acid.

The A1 horizon has hue of 7.5YR or 10YR, value of 2 through 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry. It is stony loam in the surface layer and loam, silt loam, gravelly silt loam, or gravelly, very gravelly, cobbly, or very cobbly loam or silt loam in the lower part of the A1 horizon. The B2 has hue of 7.5YR, 10YR, or 2.5Y, value of 4 through 7 dry and 3 through 5 moist, and chroma of 3 through 6 dry and moist. It is very gravelly, gravelly, or very cobbly loam; gravelly or cobbly sandy clay loam; gravelly or very cobbly sandy loam; or gravelly, very gravelly, cobbly, or very cobbly clay loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 though 7 dry and 3 through 6 moist, and chroma of 3 or 4 dry and moist. It is very gravelly clay loam, gravelly or cobbly sandy loam, very gravelly or very cobbly sandy loam, or gravelly sandy loam. The C horizon is not present in all pedons.

Pringle series

The Pringle series consists of very deep, somewhat poorly drained soils formed in alluvium weathered from sandstone, quartzite, and limestone. Pringle soils are on nearly level flood plains, stream terraces, and valley bottoms at elevations of 4,800 to 5,500 feet. Slopes range from 0 to 1 percent. Average annual precipitation is about 19 inches, and the mean annual air temperature is about 45 degrees F.

Pringle soils are near Canburn, Eastcan, Redola, Steed and Sunset soils. Canburn, Eastcan, and Redola soils all have a mollic epipedon more than 20 inches thick, and Canburn and Eastcan soils have more than 18 percent clay in the layer between depths of 19 to 40 inches. Eastcan, Redola, and Steed soils are dry for more than 60 consecutive days during the summer. All of these soils except Steed soils lack the very gravelly sand in the IIC horizon in the lower part of the soil.

Typical pedon of Pringle loam, about 1 1/2 miles north of Milton, 1,100 feet east and 2,200 feet south of the northwest corner of section 16, T. 4 N., R. 2 E.:

A11—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine pores; moderately calcareous; disseminated lime; mildly alkaline (pH 7.8); clear smooth boundary. (3 to 8 inches thick)

A12—3 to 11 inches; dark brown (10YR 3/3) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine pores; moderately calcareous; disseminated lime; mildly alkaline (pH 7.8); abrupt smooth boundary. (0 to 8 inches thick)

A13—11 to 19 inches; very dark grayish brown (10YR 3/2) stratified silt loam and very fine sandy loam, grayish brown (10YR 5/2) dry; common medium prominent yellowish red (5YR 5/6) mottles; weak medium platy structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine pores; moderately calcareous; disseminated lime; mildly alkaline (pH 7.8); abrupt wavy boundary. (8 to 12 inches thick)

IIC1—19 to 45 inches; dark brown (10YR 4/3) very gravelly sand, brown (10YR 5/3) dry; many fine distinct strong brown (7.5YR 5/8) mottles; single grained; loose; few very fine and fine roots; 55 percent gravel; mildly alkaline (pH 7.8); gradual wavy boundary. (26 to 40 inches thick)

IIC2—45 to 60 inches; dark brown (10YR 4/4) very gravelly sand, yellowish brown (10YR 5/4) dry; single grained; loose; 55 percent gravel and 15 percent cobbles; mildly alkaline (pH 7.8).

The mollic epipedon ranges from 12 to 19 inches thick. Depth to the very gravelly sand IIC horizon ranges from 19 to 25 inches. Depth to water table fluctuates with the season and ranges from 10 to more than 60 inches. It is 12 to 24 inches below the surface during the period between February and June. Mottles with chroma of 2 or less occur below a depth of 8 to 11 inches. Rock fragments are rounded gravel and cobbles, and make up 50 to 70 percent of the IIC horizon. Reaction is mildly to moderately alkaline.

The A11 and A12 horizons have hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. They are loam or silt loam. The A13 horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 through 4 dry and moist. It has stratified layers of silt loam, sandy loam, very fine sandy loam, and loamy fine sand. Mottles range from common medium prominent to common fine distinct. The IIC horizon has hue of 10YR, value of 5 or 6 dry and 4 moist, and chroma of 3 or 4 dry and moist.

Redcan series

The Redcan series consists of shallow, well drained soils formed in materials weathered from sandstone and shale. Redcan soils are on very steep, south- and west-facing mountainsides at elevations of 6,000 to 7,000 feet. Slopes range from 40 to 60 percent. The average annual precipitation is about 18 inches, and the mean annual temperature is about 40 degrees F.

Redcan soils are near Hoskin, Guilder, Etchen, and Yeljack soils. Hoskin soils have a mollic epipedon and are 20 to 40 inches deep to bedrock. Guilder soils have a B2t horizon and are more than 40 inches deep to bedrock. Etchen soils have a B2t horizon and are 20 to 40 inches deep to bedrock. Yeljack soils have a mollic epipedon, an A2 horizon, and a B2t horizon and are deep.

Typical pedon of Redcan cobbly loam, 40 to 60 percent slopes, in an area of Redcan-Etchen complex, 25 to 60 percent slopes, about 7 miles east and 1 mile south of Lost Creek Dam at a point 300 feet east and 400 feet south of the northwest corner of section 15, T. 5 N., R. 6 E.:

A1—0 to 2 inches; dark red (2.5YR 3/6) cobbly loam, red (2.5YR 5/6) dry; strong thin and medium platy structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; 25 percent angular cobbles; strongly calcareous; disseminated lime; moderately alkaline (pH 8.4); abrupt smooth boundary. (2 to 6 inches thick)

C1—2 to 6 inches; dark red (2.5YR 3/6) cobbly loam, red (2.5YR 5/6) dry; strong medium platy structure parting to moderate very fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine and few medium roots; 30 percent angular cobbles and gravel; strongly calcareous; disseminated lime; moderately alkaline (pH 8.0); clear wavy boundary. (4 to 5 inches thick)

C2—6 to 15 inches; red (2.5YR 4/6) very gravelly loam, red (2.5YR 5/6) dry; strong fine and medium angular blocky structure; hard, firm, slightly sticky and plastic; few very fine, fine, and medium roots; 60 percent fine angular gravel; strongly calcareous; disseminated lime; moderately alkaline (pH 8.0); abrupt irregular boundary. (8 to 10 inches thick)

C3r—15 to 20 inches; weathered red shale.

Weathered shale or calcareous sandstone is at a depth of 15 to 20 inches. Rock fragments consist of angular gravel and cobbles; they make up 25 to 35 percent of the A1 horizon and 30 to 70 percent of the C horizons.

The A horizon has hue of 2.5YR, value of 4 or 5 dry and 3 moist, and chroma of 6 dry and moist. It is cobbly loam or cobbly clay loam. The C horizon has hue of 2.5YR or 10R, value of 5 dry and 3 or 4 moist, and chroma of 6 dry and 4 through 6 moist. It is very gravelly, gravelly, or cobbly loam or very gravelly clay loam.

Redola series

The Redola series consists of very deep, well drained soils formed in alluvium weathered from sandstone, quartzite, and limestone. They are on nearly level and gently sloping flood plains and stream terraces at elevations of 4,900 to 5,100 feet. Slopes are 0 to 2 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Redola soils are similar to Phoebe soils. They are near Eastcan, Pringle, and Sunset soils. Phoebe soils have a mollic epipedon less than 20 inches thick. Eastcan soils have 18 to 35 percent clay in the layer between depths of 10 to 25 inches. Pringle soils have a mollic epipedon less than 20 inches thick, have a seasonal high water table at a depth of 12 to 24 inches, and are very gravelly sand below a depth of 19 to 25 inches. Sunset soils have a mollic epipedon less than 20 inches thick and a seasonal high water table at a depth of 30 to 36 inches.

Typical pedon of Redola loam in an area of Redola loam, 0 to 2 percent slopes in a cultivated area in Morgan County, about 5/8 mile west of Morgan County Courthouse, 1,700 feet east and 2,250 feet north of the southwest corner of section 35, T. 4 N., R. 2 E.:

Ap—0 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; mildly alkaline (pH 7.6); moderately calcareous; abrupt smooth boundary. (9 to 11 inches thick)

A12—11 to 24 inches; dark brown (10YR 2/2) silt loam, dark brown (10YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common fine and very fine pores; mildly alkaline (pH 7.6); moderately calcareous; abrupt smooth boundary. (13 to 14 inches thick)

C1—24 to 42 inches; dark brown (7.5YR 4/2) fine sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common very fine pores; mildly alkaline (pH 7.6); moderately calcareous; gradual smooth boundary. (18 to 33 inches thick)

C2—42 to 60 inches; dark brown (7.5YR 4/2) fine sandy loam, brown (10YR 5/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.6); moderately calcareous.

The mollic epipedon is 22 to 25 inches thick and the organic-matter content increases irregularly with depth. The layer between depths of 10 and 40 inches is stratified loam, silt loam, very fine sandy loam, fine sandy loam, or sandy loam and averages less than 18 percent clay. Reaction is mildly alkaline. The A1 horizon is slightly calcareous to moderately calcareous and the C horizon is moderately calcareous to strongly calcareous.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is loam, silt loam, very fine sandy loam, or fine sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is sandy loam or fine sandy loam and is stratified with thin layers of silt loam, loam, or very fine sandy loam.

Richens series

The Richens series consists of deep, well drained soils formed in glacial till, mostly from a conglomerate of sandstone and quartzite. Richens soils are on undulating and rolling high mountaintops at elevations of 7,500 to 8,200 feet. Slopes range from 3 to 15 percent. The average annual precipitation is about 35 inches, and the mean annual air temperature is about 41 degrees F.

Richens soils are near Herd and Yence soils. Herd and Yence soils both lack a mollic epipedon. Yence soils have more than 35 percent rock fragments in the B2t horizon.

Typical pedon of Richens loam in an area of Richens loam, 3 to 15 percent slopes, about 6 miles north of Devils Slide, 800 feet west and 2,100 feet north of the southeast corner of section 14, T. 5 N., R. 3 E.:

O1—1/2 inch to 0; leaves and old grass. (0 to 1 inch thick)

A11—0 to 8 inches; very dark brown (10YR 2/2) loam, dark yellowish brown (10YR 3/4) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 5 percent gravel; slightly acid (pH 6.2); clear wavy boundary. (3 to 10 inches thick)

A12—8 to 17 inches; very dark brown (10YR 2/2) loam, dark yellowish brown (10YR 3/4) dry; weak fine subangular blocky structure parting to moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; 5 percent gravel; slightly acid (pH 6.2); abrupt wavy boundary. (8 to 17 inches thick)

A2—17 to 19 inches; strong brown (7.5YR 5/6) cobbly silt loam, light brown (7.5YR 6/4) dry; weak medium and coarse subangular blocky structure; hard, friable, slighty sticky and plastic; few fine and medium roots; 40 percent cobbles and gravel; slightly acid (pH 6.2); abrupt wavy boundary. (2 to 5 inches thick)

B21t—19 to 24 inches; yellowish red (5YR 5/8) gravelly silty clay, reddish yellow (5YR 6/6) dry; moderate medium prismatic structure parting to strong medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; many thin clay films on peds; 25 percent gravel and cobbles; slightly acid (pH 6.4); clear wavy boundary. (5 to 14 inches thick)

B22t—24 to 33 inches; yellowish red (5YR 5/8) clay, reddish yellow (5YR 6/6) dry; strong coarse prismatic structure parting to strong medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine and medium roots; continuous moderately thick clay films on peds; slightly acid (pH 6.4); clear wavy boundary. (9 to 23 inches thick)

B23t—33 to 56 inches; red (2.5YR 5/8) clay, red (2.5YR 5/6) dry; moderate coarse prismatic structure parting to strong medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few medium roots; continuous moderately thick clay films on peds; neutral (pH 6.6); abrupt wavy boundary. (0 to 23 inches thick)

Cr—56 to 68 inches; weathered sandstone.

The mollic epipedon is 17 to 21 inches thick. Depth to the upper boundary of the B2t horizon ranges from 19 to 23 inches. The combined thickness of the A1, A2, and B2t horizons ranges from 55 to 60 inches or more over bedrock. Rock fragments consist of rounded gravel and cobbles; they make up 0 to 40 percent of the lower part of the A1 horizon, 30 to 70 percent of the A2 horizon, and 0 to 25 percent of the upper 6 to 12 inches of the B2t horizon. Reaction is slightly acid to neutral in the A1 and A2 horizons and medium to slightly acid in the B2t horizon.

The A1 horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 3 or 4 dry and 2 or 3 moist. It is loam in the upper part and loam or cobbly loam in the lower part. The A2 horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6 dry and 6 moist. It is cobbly silt loam, cobbly silty clay loam, or very cobbly loam. The B2t horizon has hue of 10R, 2.5YR, or 5YR, value of 4 through 6 dry and 4 or 5 moist, and chroma of 6 through 8 dry and moist. It is clay, silty clay, gravelly silty clay, or heavy silty clay loam.

Richville series

The Richville series consists of moderately deep, well drained soils formed in materials weathered mostly from tuffaceous sandstone. Richville soils are on south- and west-facing mountain foot slopes at elevations of 5,100 to 6,000 feet. Slopes range from 30 to 60 percent. Average annual precipitation is about 18 inches, and mean annual air temperature is about 45 degrees F.

Richville soils are near Hawkins, Mondey, and Stoda soils. Hawkins soils have a clay B2 horizon and have cracks in late summer. Mondey soils have a clay B2t horizon. Stoda soils have mean annual temperature warmer than 47 degrees F and have a mollic epipedon.

Typical pedon of Richville gravelly loam in an area of Richville gravelly loam, 30 to 60 percent slopes, about 1 1/4 miles south and 1 1/2 miles west of Morgan Courthouse, approximately 2,400 feet west and 300 feet south of the northeast corner of section 3, T. 3 N., R. 2 E.:

A1—0 to 4 inches; dark brown (7.5YR 3/2) gravelly loam, dark brown (7.5YR 4/3) dry; weak fine granular structure; soft, very friable, sticky and slightly plastic; common very fine and few fine and medium roots; 40 percent gravel and 10 percent cobbles on surface; moderately calcareous; disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary. (3 to 6 inches thick)

B2—4 to 12 inches; brown (7.5YR 4/3) gravelly clay loam, light brown (7.5YR 6/4) dry; weak medium subangular blocky structure parting to weak medium granular structure; slightly hard, firm, sticky and plastic; common very fine and few fine and medium roots; few fine pores; 30 percent gravel; moderately calcareous; disseminated lime; moderately alkaline (pH 8.2); clear wavy boundary. (8 to 14 inches thick)

C1ca—12 to 18 inches; brown (7.5YR 5/4) clay loam, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; 5 percent gravel; strongly calcareous; veins and flakes of lime; moderately alkaline (pH 8.2); clear smooth boundary. (6 to 16 inches thick)

C2ca—18 to 28 inches; brown (7.5YR 5/4) loam, light brown (7.5YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine pores; strongly calcareous; veins and flakes of lime; moderately alkaline (pH 8.4); clear smooth boundary. (0 to 12 inches thick)

C3r—28 to 39 inches; weathered tuffaceous sandstone.

IIC4r—39 to 40 inches; weathered conglomerate of quartzite and sandstone.

The A1 horizon in the upper 3 to 6 inches has value and chroma of less than 3.5 when moist. The texture in the layer between a depth of 10 inches and weathered sandstone is loam, silt loam, clay loam, or silty clay loam with 18 to 35 percent clay. Weathered tuffaceous sandstone is at a depth of 28 to 40 inches. Rock fragments consist of quartzite gravel; they make up 0 to 30 percent of the A1 and B2 horizons and 0 to 20 percent of the Cca horizon. Reaction is moderately alkaline to strongly alkaline and the soil is moderately calcareous in the A1 and B2 horizons and moderately to strongly calcareous in the Cca horizon.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 and 5 dry and 3 or 4 moist, and chroma of 2 or 3 dry and moist. It is gravelly loam or loam. The B2 has hue of 10YR and 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or 4. It is gravelly clay loam or loam. The Cca

horizon has hue of 7.5YR, value of 6 through 8 dry and 5 or 6 moist, and chroma of 2 through 4 dry and 4 through 6 moist. It is clay loam, loam, silt loam, or silty clay loam.

Scave series

The Scave series consists of very deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Scave soils are on moderately steep, steep, and very steep mountainsides at elevations of 7,500 to 9,200 feet. Slopes are 15 to 60 percent. The average annual precipitation is about 35 inches, and the mean annual air temperature is 41 degrees F.

Scave soils are similar to Toone soils. They are near Charcol, Lucky Star, and Schuster soils. All of these soils lack the abrupt texture change between the A2 and B2t horizons. Toone and Charcol soils have a mollic epipedon thicker than 20 inches. Charcol, Lucky Star, and Schuster soils all have less than 35 percent clay in the B2t horizon.

Typical pedon of Scave loam in an area of Scave loam, 30 to 60 percent slopes, in Morgan County, 4 1/2 miles east and 7 1/4 miles south of East Canyon Dam, 1,815 feet south and 1,150 feet west of the northeast corner of section 17, T. 1 N., R. 4 E.:

O1—2 inches to 0; leaves and duff.

A11—0 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine and few medium pores; 5 percent gravel; medium acid (pH 5.8); abrupt wavy boundary. (4 to 9 inches thick)

A12—9 to 19 inches; very dark brown (10YR 2/2) cobbly loam, dark grayish brown (10YR 4/2) dry; weak coarse granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine and common medium pores; 25 percent cobbles and 20 percent gravel; medium acid (pH 5.8); abrupt wavy boundary. (8 to 10 inches thick)

A21—19 to 33 inches; brown (7.5YR 5/4) very gravelly fine sandy loam, pink (7.5YR 7/4) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine pores; 30 percent gravel and 20 percent cobbles; medium acid (pH 5.8); gradual smooth boundary. (7 to 14 inches thick)

A22—33 to 39 inches; brown (7.5YR 5/4) very cobbly fine sandy loam, pink (7.5YR 7/4) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and few medium pores; 40 percent cobbles and 20 percent gravel; medium acid (pH 5.8); abrupt wavy boundary. (6 to 7 inches thick)

B2t—39 to 60 inches; reddish brown (5YR 4/4) very cobbly clay, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; continuous thin clay films on peds; 30 percent cobbles and 30 percent gravel; medium acid (pH 5.8).

The mollic epipedon is 11 to 20 inches. The combined thickness of the A1, A2, and B2t horizon ranges from 24 to 49 inches. The upper 20 inches of the B2t horizon is 35 to 55 percent rock fragments and more than 35 percent clay. The rock fragments are mainly rounded quartzite gravel and cobbles; they make up 5 to 20 percent of the upper part of the A1 horizon and 10 to 50 percent of the lower part, 40 to 70 percent of the A2 horizon, and 35 to 60 percent of the B2t horizon. Reaction is slightly acid to medium acid in the A1 horizon, medium acid to strongly acid in the A2 horizon, and medium acid in the B2t horizon.

The A1 horizon has hue of 10YR, value of 2 through 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 3 moist. It is loam or silt loam in the upper part and loam, silt loam, or cobbly loam in the lower part. The A2 horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 through 7 dry and 4 or 5 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is very cobbly or very gravelly loam, very fine sandy loam, fine sandy loam, or sandy loam. The B2t horizon has hue of 5YR or 7.5YR, value of 5 through 7 dry and 3 through 5 moist, and chroma of 4 through 6 dry and 4 through 8 moist. It is gravelly, very gravelly, cobbly, or very cobbly clay or heavy clay loam.

Schuster series

The Schuster series consists of deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Schuster soils are on very steep mountainsides at elevations of 5,800 to 8,200 feet. Slopes are 30 to 60 percent. The average annual precipitation is about 28 inches, and the mean annual air temperature is about 41 degrees F.

Schuster soils are similar to Lucky Star and Nordic soils. They are near Charcol, Condie, Etchen, Henhoit, and St. Marys soils. Lucky Star soils have a mixed A and B horizon. Nordic soils have hue of 10YR or 7.5YR in the B2t horizon, and the upper boundary of the B2t horizon is at a depth of 40 to 46 inches. Charcol soils have a mollic epipedon more than 20 inches thick. Condie soils lack a mollic epipedon. Etchen soils lack a mollic epipedon and an A2 horizon and are 20 to 40 inches deep over bedrock. Henhoit soils lack an A2 horizon and are slightly warmer during the summer months. St. Marys soils lack A2 and B2t horizons and are slightly warmer during the summer months.

Typical pedon of a Schuster loam in an area of Schuster loam, 30 to 60 percent slopes, about 3 1/4 miles west and 3 1/4 miles south of East Canyon Dam, at a point 600 feet west and 66 feet north of the south quarter-corner of section 30, T. 2 N., R. 3 E.:

O1—1 inch to 0; leaves.

A11—0 to 6 inches; dark brown (7.5YR 3/2) loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 10 percent gravel; slightly acid (pH 6.4); abrupt smooth boundary. (6 to 13 inches thick)

A12—6 to 18 inches; dark brown (7.5YR 3/2) loam, brown (10YR 4/3) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 10 percent gravel; slightly acid (pH 6.2); clear irregular boundary. (6 to 14 inches thick)

A2—18 to 29 inches; brown (7.5YR 4/4) gravelly fine sandy loam, strong brown (7.5YR 5/6) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common fine pores; 25 percent gravel and 5 percent cobbles; medium acid (pH 6.0); clear wavy boundary. (8 to 18 inches thick)

B21t—29 to 44 inches; dark red (2.5YR 3/6) gravelly clay loam, red (2.5YR 4/6) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common fine pores; common thin clay films on peds; 40 percent gravel and 5 percent cobbles; medium acid (pH 6.0); abrupt wavy boundary. (9 to 19 inches thick)

B22t—44 to 63 inches; dark red (2.5YR 3/6) very gravelly clay loam, red (2.5YR 4/6) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; few thin clay films on peds; 65 percent gravel and 10 percent cobbles; slightly acid (pH 6.2).

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1, A2, and B2t horizons is 47 to 60 inches or more. Rock fragments consist of quartzite and sandstone gravel and cobbles; they make up 0 to 30 percent of the A1 horizon, 20 to 50 percent of the A2 horizon, and 35 to 75 percent of the B2t horizon. Reaction is slightly or medium acid.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 2 moist. It is loam or gravelly loam. The A2 horizon has hue of 7.5YR or 5YR, value of 4 through 7 dry and 4 or 5 moist, and chroma of 4 through 6 dry and moist. It is gravelly fine sandy loam or gravelly, cobbly, or very cobbly loam. The B2t horizon has hue of 2.5YR and 5YR, value of 4 or 5 dry and 3 through 5 moist, and chroma of 6 through 8 dry and moist. It is gravelly, very gravelly, or very cobbly clay loam or very gravelly or cobbly loam.

Sessions series

The Sessions series consists of very deep, well drained soils formed in materials weathered from a conglomerate of sandstone and quartzite and some gneiss, schist, argillite, and phyllite. Sessions soils are on dominantly north- and east-facing moderately steep and steep high mountainsides. The elevations are 6,100 to 6,500 feet. Slopes range from 15 to 25 percent. The average annual precipitation is about 25 inches, and the mean annual air temperature is about 42 degrees F.

Sessions soils are similar to Richens soils. They are near Bertag, Hawkins, Nordic, and Poleline soils. Richens soils have a mollic epipedon that is 17 to 21 inches thick. Bertag and Poleline soils have a mollic epipedon that is more than 20 inches thick. Poleline soils lack a B2t horizon and have more than 35 percent rock fragments and less than 35 percent clay in the layer between depths of 10 and 40 inches. Hawkins soils lack a B2t horizon and crack to the surface in late summer. Nordic soils have more than 35 percent rock fragments and 18 to 35 percent clay in the B2t horizon.

Typical pedon of a Sessions cobbly loam in an area of Sessions cobbly loam, 15 to 25 percent slopes, about 3 miles southwest of Peterson near Dalton Creek at a point 1,450 feet west and 1,000 feet south of the northeast corner of section 23, T. 4 N., R. 2 E.:

A11—0 to 3 inches; very dark brown (10YR 2/2) cobbly loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium granular structure; soft, friable, sticky and plastic; common very fine, fine, and medium roots; 20 percent cobbles and 10 percent gravel; neutral (pH 6.6); abrupt smooth boundary. (1 to 5 inches thick)

A12—3 to 11 inches; very dark brown (10YR 2/2) cobbly loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to moderate medium and coarse granular structure; slightly hard, firm, sticky and plastic; common very fine, fine, and medium roots; 20 percent cobbles and 10 percent gravel; neutral (pH 6.9); clear wavy boundary. (6 to 10 inches thick)

B21t—11 to 20 inches; reddish brown (5YR 4/3) cobbly clay, reddish brown (5YR 5/3) dry; weak medium prismatic structure parting to moderate medium and coarse subangular blocky structure; very hard, very firm, sticky and very plastic; common very fine, fine, and medium roots; common fine pores; continuous moderately thick clay films on peds and in pores; 15 percent cobbles and 10 percent gravel; neutral (pH 6.8); clear smooth boundary. (8 to 16 inches thick)

B22t—20 to 31 inches; reddish brown (5YR 4/3) cobbly clay loam, reddish brown (5YR 5/3) dry; weak medium prismatic structure parting to moderate medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; common very fine, fine, and medium roots; common fine pores; many moderately thick clay films on peds and in pores; 15 percent cobbles and 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary. (8 to 15 inches thick)

B23t—31 to 43 inches; reddish brown (5YR 4/3) gravelly clay, light reddish brown (5YR 6/3) dry; moderate medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; few fine pores; many thin clay films on peds; 15 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); clear wavy boundary. (6 to 12 inches thick)

B24t—43 to 48 inches; reddish brown (5YR 4/3) gravelly clay loam, light reddish brown (5YR 6/3) dry; moderate medium and coarse subangular blocky structure; very hard, extremely firm, sticky and very plastic; few very fine, fine, and medium roots; few fine pores; common thin clay films on peds; 15 percent gravel and 5 percent cobbles; neutral (pH 6.6); abrupt wavy boundary. (0 to 8 inches thick)

C—48 to 60 inches; dark reddish gray (5YR 4/2) clay loam, reddish gray (5YR 5/2) dry; weak medium subangular blocky structure; hard, very firm, sticky and plastic; few very fine, fine, and medium roots; 5 percent gravel; neutral (pH 6.8).

The mollic epipedon is 11 to 15 inches thick. The combined thickness of the A1 and B2t horizons is 48 to more than 60 inches. The upper 20 inches of the B2t horizon is cobbly clay or clay loam with 35 to 42 percent clay, 10 to 15 percent cobbles, and 5 to 10 percent gravel.

Smarts series

The Smarts series consists of deep and very deep, well drained soils formed in materials weathered from argillite, phyllite, schist, and quartzite. They are on north-, east-, and in some places west-facing, very steep mountainsides at elevations of 5,200 to 8,200 feet. Slopes range from 40 to 70 percent. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 44 degrees F.

Smarts soils are similar to Toncana soils. They are near Broad Canyon, Durfee, Durst, Lucky Star, Poleline, and Yeates Hollow soils. Toncana soils have hue of 5YR or 2.5YR in the B2t horizon. Broad Canyon and Durst soils have a mollic epipedon that is less than 20 inches thick. Broad Canyon soils lack a B2t horizon. Durfee and Yeates Hollow soils have more than 35 percent clay in the B2t horizon. Lucky Star soils have a mollic epipedon that is less than 16 inches thick and an A2 horizon. Poleline soils have summer soil temperature of less than 59 degrees F.

Typical pedon of a Smarts loam in an area of Smarts loam, 40 to 60 percent slopes, (fig. 10) in Weber County, 2 1/4 miles north and 1 mile east of Liberty, about 400 feet east of the south quarter-corner of section 4, T. 7 N., R. 1 E.:

A11—0 to 8 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 4/3) dry; moderate, fine granular structure; soft, friable, nonsticky and slightly plastic; many very fine and fine and few medium roots; 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary. (2 to 10 inches thick)

A12—8 to 18 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark brown (10YR 4/3) dry; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; 20 percent gravel; slightly acid (pH 6.4); clear wavy boundary. (6 to 17 inches thick)

A13—18 to 26 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine

and fine and few medium roots; few very fine pores; 40 percent gravel, 5 percent cobbles; slightly acid (pH 6.4); clear wavy boundary. (0 to 14 inches thick)

B21t—26 to 43 inches; brown (7.5YR 4/4) gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine and few fine pores; 40 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); gradual wavy boundary. (5 to 20 inches thick)

B22t—43 to 72 inches; brown (7.5YR 4/4) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; few very fine, fine and medium roots; many very fine and few fine pores; 35 percent gravel, 20 percent cobbles; slightly acid (pH 6.2).

The mollic epipedon is 20 to 28 inches thick. The combined thickness of the A1 and B2t horizons is 40 to more than 60 inches. Rock fragments consist of gravel, cobbles, and a few stones and are dominantly angular in shape. Rock fragment content ranges from 15 to 45 percent in the A1 horizon and from 35 to 65 percent in the B2t horizon. Reaction is strongly acid through neutral in the A1 horizon and strongly acid or slightly acid in the B2t horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam in the upper part and loam, gravelly or cobbly loam or light clay loam in the lower part. The B2t horizon has hue of 10YR or 7.5YR, value of 5 through 7 dry and 3 through 5 moist, and chroma of 2 through 5 dry and 3 or 4 moist. It is gravelly or very gravelly loam, clay loam, cobbly or very cobbly clay loam, or silty clay loam.

Depth to bedrock is dominantly more than 60 inches but is 40 to 50 inches in the area mapped as Smarts loam, moderately deep, 40 to 70 percent slopes.

Steed series

The Steed series consists of very deep, well drained soils formed in alluvium from quartzite, sandstone, and limestone. Steed soils are on nearly level and gently sloping stream terraces and flood plains at elevations of 5,000 to 5,150 feet. Slopes are 0 to 3 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Steed soils are similar to Utaba soils. They are near Eastcan, Parlo, Pringle, and Sunset soils. Utaba soils have a mollic epipedon more than 20 inches thick and have mean annual soil temperature of less than 47 degrees F. Eastcan soils have a mollic epipedon more than 20 inches thick and less than 35 percent rock fragments in the layer between depths of 10 and 40 inches. Parlo soils have a B2t horizon that is less than 20 percent rock fragments. Unless drained, Pringle soils have a seasonal high water table at a depth of 12 to 24 inches. Pringle and Sunset soils have less than 20 percent rock fragments in the layer between depths of 10 and 40 inches.

Typical pedon of a Steed cobbly loam in an area of Steed cobbly loam, 0 to 3 percent slopes, in Morgan County, 1,650 feet northeast of Morgan High School, 1,350 feet west and 250 feet north of the east quarter-corner of section 36, T. 4 N., R. 2 E.:

Ap1—0 to 4 inches; very dark grayish brown (10YR 3/5) cobbly loam, brown (10YR 5/2) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; few fine and medium pores; 20 percent cobbles and 15 percent gravel; moderately calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary. (4 to 10 inches thick)

Ap2—4 to 8 inches; dark brown (7.5YR 3/2) gravelly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure parting to weak medium granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; few fine and medium pores; 25 percent gravel; moderately calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary. (0 to 9 inches thick)

C1—8 to 13 inches; dark brown (7.5YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine pores; 25 percent gravel, moderately calcareous; moderately alkaline (pH 8.2); abrupt wavy boundary. (0 to 11 inches thick)

IIC2—13 to 35 inches; dark yellowish brown (10YR 4/4) very gravelly sand, pale brown (10YR 6/3) dry; single grained; loose; common very fine and fine roots; 50 percent gravel, 30 percent cobbles, and 2 percent stones; slightly calcareous; moderately alkaline (pH 8.0); abrupt wavy boundary. (11 to 38 inches thick)

IIC3—35 to 62 inches; dark yellowish brown (10YR 4/4) very gravelly sand, pale brown (10YR 4/4) dry; single grained; loose; few very fine and fine roots; 40 percent gravel, 35 percent cobbles, and 2 percent stones; slightly calcareous; moderately alkaline (pH 8.0).

The mollic epipedon is 8 to 17 inches thick. Depth to the IIC horizon is 13 to 28 inches. The IIC horizon does not have enough soil material to fill the space between the rock fragments. Rock fragments are mostly pebbles and cobbles; they make up 0 to 35 percent of the A1 horizon and 25 to 55 percent of the IIC horizon. The soil is slightly to strongly calcareous in the A1 horizon, slightly to moderately calcareous in the C horizon, and slightly calcareous in the IIC horizon. Reaction is moderately alkaline throughout.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 moist, and chroma of 2 through 4 dry and and 2 or 3 moist. It is loam or cobbly loam in the upper part and loam, gravelly or cobbly loam, or gravelly fine sandy loam in the lower part. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 4 dry and 2 through 4 moist. It is gravelly loam or very gravelly fine sandy loam. The IIC horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 or 6 dry and 3 through 5 moist, and chroma of 3 or 4 dry and 4 moist. It is very gravelly loamy sand, coarse sand, or sand.

St. Marys series

The St. Marys series consists of deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. St. Marys soils are dominantly on south- and west-facing, very steep mountainsides, but are also on sloping to moderately steep alluvial fans. Slopes are 3 to 60 percent, and the elevations are 5,500 to 8,900 feet. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 44 degrees F.

St. Marys soils are similar to Burgi and Patio soils. They are near Guilder, Hoskin, Lucky Star, and Moweba soils. Burgi and Moweba soils have a mollic epipedon more than 20 inches thick. Patio and Moweba soils have a base saturation of less than 75 percent in some part or all of the upper 30 inches. Guilder soils lack a mollic epipedon and a B2t horizon that are less than 35 percent rock fragments and more than 35 percent clay. Hoskin soils have a B2t horizon and have bedrock at a depth of 20 to 40 inches. Lucky Star soils have A2 and A&B horizons.

Typical pedon of St. Marys cobbly loam in an area of Moweba-St. Marys complex, 30 to 50 percent slopes, in Morgan County, about 3 miles north and 6 miles east of Croydon, 10 feet west of the south quarter-corner of section 4, T. 4 N., R. 5 E.:

O1—2 inches to 0; leaves and twigs. (0 to 2 inches thick)

A11—0 to 7 inches; very dark brown (10YR 2/2) cobbly loam, brown (10YR 4/3) dry; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; 20 percent cobbles and 20 percent gravel; neutral (pH 6.6); clear smooth boundary. (2 to 12 inches thick.

A12—7 to 14 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 4/3) dry; weak medium subangular blocky structure parting to weak medium granular structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; 20 percent cobbles and 20 percent gravel; neutral (pH 6.6); gradual smooth boundary. (5 to 14 inches thick)

B2—14 to 24 inches; yellowish red (5YR 4/6) very cobbly sandy clay loam, reddish yellow (5YR 6/6) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common fine pores; 30 percent cobbles and 25 percent gravel; neutral (pH 6/6) clear smooth boundary. (10 to 38 inches thick)

C1—24 to 39 inches, yellowish red (5YR 5/6) very gravelly sandy loam, reddish yellow (5YR 6/6) dry; massive; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; 35 percent gravel and 35 percent cobbles; neutral (pH 6.6); clear smooth boundary. (13 to 15 inches thick)

C2—39 to 46 inches; yellowish red (5YR 4/6) very gravelly sandy loam, yellowish red (5YR 5/6) dry; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; 35 percent gravel and 30 percent cobbles; neutral (pH 6.6); clear smooth boundary. (0 to 7 inches thick)

C3—46 to 60 inches; yellowish red (5YR 4/6) very gravelly sandy loam, yellowish red (5YR 5/6) dry; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; 35 percent gravel and 30 percent cobbles; slightly acid (pH 6.4).

The mollic epipedon is 10 to 20 inches thick. Depth to bedrock is 40 to more than 60 inches. The layer between depths of 10 and 40 inches is very cobbly or very gravelly sandy clay loam, sandy loam, fine sandy loam, and cobbly or gravelly loam with 35 to 75 percent rock fragments. The rock fragments are rounded quartzite cobbles, gravel, and stones; they make up 5 to 65 percent (dominantly 35 to 65 percent) of the A1 horizon, 35 to 80 percent of the B2 horizon, and 40 to 85 percent of the C horizon. The soil is mainly slightly acid to neutral and noncalcareous. In the St. Marys-Guilder complex, however, the St. Marys soil is neutral to moderately alkaline and slightly calcareous to strongly calcareous.

The A1 horizon has hue of 10YR, 7.5YR, and 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. It is cobbly, very cobbly, gravelly, very gravelly, or very stony loam, loam, or very cobbly fine sandy loam. The B2 horizon has hue of 5YR or 2.5YR, value of 4 through 6 dry and 3 through 5 moist, and chroma of 3 through 6 dry and 4 through 6 moist. It is very cobbly or very gravelly sandy clay loam, loam, sandy loam, gravelly loam, or very gravelly fine sandy loam. The C horizon has hue of 7.5YR or 2.5YR, value of 3 through 6 dry and 3 through 5 moist, and chroma of 4 through 6 dry and 4 through 8 moist. It is very cobbly sandy clay loam, loam, sandy loam, loamy fine sand, very gravelly sandy loam, fine sandy loam, or gravelly fine sandy loam.

Stoda series

The Stoda series consists of very deep, well drained soils formed in lacustrine sediments mostly from tuffaceous sandstone and quartzite. Stoda soils are on lake terraces and lake terrace escarpments and have slopes of 10 to 60 percent. The elevations are 4,800 to 5,150 feet. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Stoda soils are similar to Collinston soils. They are near Manila, Nebeker, Parleys, and Yeates Hollow soils. Collinston soils have more silt and very fine sand in the layer at depths between 10 and 40 inches and are fine-silty. Manila soils have a clay B2t horizon. Nebeker soils have a mollic epipedon more than 20 inches thick and a clay B2t horizon. Parleys soils have a silty clay loam or clay loam B2t horizon. Yeates Hollow soils have a B2t horizon that is more than 35 percent rock fragments and more than 35 percent clay.

Typical pedon of Stoda loam in an area of Stoda loam, 40 to 60 percent slopes, about 3 miles north of Peterson at a point 2,200 feet west and 40 feet north of the west quarter-corner of section 30, T. 5 N., R. 2 E.:

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; weak medium platy structure parting to moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly calcareous; disseminated lime; mildly alkaline (pH 7.6); abrupt smooth boundary. (3 to 7 inches thick)

A12—6 to 11 inches; dark brown (10YR 3/3) loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure parting to weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; few fine pores; moderately calcareous; disseminated lime; moderately alkaline (pH 8.4); clear wavy boundary. (5 to 16 inches thick)

B2—11 to 19 inches; dark brown (7.5YR 4/3) loam, light yellowish brown (10YR 6/4) moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common fine and medium pores; strongly calcareous; disseminated lime; strongly alkaline (pH 8.6); gradual smooth boundary. (5 to 8 inches thick)

C1ca—19 to 29 inches; brown (7.5YR 5/4) loam, pink (7.5YR 7/5) dry; moderate coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine pores; strongly calcareous; veins of lime; strongly alkaline (pH 8.8); clear wavy boundary. (8 to 10 inches thick)

C2ca—29 to 36 inches; light brown (7.5YR 6/4) silt loam, pink (7.5YR 7/4) dry; weak medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine and fine roots; common very fine pores; strongly calcareous; veins of lime; strongly alkaline (pH 8.8); clear irregular boundary. (7 to 25 inches thick)

C3ca—36 to 46 inches; brown (7.5YR 5/4) silt loam, very pale brown (10YR 7/4) dry; few coarse faint (10YR 6/6) mottles; massive; hard, friable, sticky and slightly plastic; few very fine and fine roots; many very fine pores; strongly calcareous; veins of lime; strongly alkaline (pH 9.0); clear smooth boundary. (0 to 12 inches thick)

C4—46 to 67 inches; brown (10YR 5/4) very fine sandy loam, very pale brown (7.5YR 7/4) dry; massive; very friable, slightly sticky and nonplastic; strongly calcareous; disseminated lime; strongly alkaline (pH 9.0).

The mollic epipedon is 11 to 18 inches thick. The texture in the layer at depths between 10 and 40 inches is loam or silt loam with 18 to 27 percent clay. The soil is calcareous throughout, and depth to the lime accumulation layer is 19 to 23 inches. Reaction is mildly or moderately alkaline in the A horizon and moderately or strongly alkaline in the B and C horizons.

The A horizon has hue of 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is loam or silt loam. The B2 horizon has hue of 10YR or 7.5YR, value of 6 dry and 4 moist, and chroma of 2 through 4 dry and moist. It is loam or silt loam. The Cca horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 6 or 7 dry and 4

through 6 moist, and chroma of 2 through 4 dry and moist. It is silt loam or loam. The Cca horizon is strongly calcareous, contains veins of lime, and is blocky or bedded. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 moist and 5 to 7 dry, and chroma of 4 dry and moist. It is loam, very fine sandy loam, silt loam, or silty clay loam.

Sunset series

The Sunset series consists of very deep, somewhat poorly drained soils that formed in alluvium from sandstone, quartzite, and limestone. Sunset soils are on nearly level flood plains and stream terraces at elevations of 4,800 to 5,150 feet. Slopes are 0 to 1 percent. The average annual precipitation is about 18 inches, and the mean annual air temperature is about 46 degrees F.

Sunset soils are similar to Pringle soils. They are near Canburn, Eastcan, Pringle, Redola, and Steed soils. Pringle soils have a very gravelly sand IIC horizon at a depth of 19 to 25 inches. Canburn and Eastcan soils have more than 18 percent clay in the layer between depths of 10 and 40 inches and have a mollic epipedon more than 20 inches thick. Redola soils have a mollic epipedon more than 20 inches thick and lack mottles above a depth of 40 inches. Steed soils have very gravelly or cobbly sand through most of the layers between depths of 10 to 40 inches.

Typical pedon of Sunset loam, in an area of Sunset loam, very gravelly substratum, in Morgan County, 1 mile southeast of Peterson, 1,300 feet east and 1,800 feet south of the northwest corner of section 8, T. 4 N., R. 2 E.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; moderately calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary. (3 to 9 inches thick)

A12—7 to 17 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure parting to weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common fine and few medium pores; 10 percent gravel; moderately calcareous; moderately alkaline (pH 8.2); abrupt wavy boundary. (6 to 16 inches thick)

C1—17 to 24 inches; dark brown (10YR 4/3) loam, yellowish brown (10YR 5/4) dry; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine and few medium pores; moderately calcareous; moderately alkaline (pH 8.2); clear wavy boundary. (3 to 10 inches thick)

C2—24 to 30 inches; dark brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine pores; moderately calcareous; moderately alkaline (pH 8.2); clear smooth boundary. (0 to 11 inches thick)

C3—30 to 36 inches; dark yellowish brown (10YR 4/4) very fine sandy loam, light yellowish brown (10YR 6/4) dry; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few fine pores; slightly calcareous; moderately alkaline (pH 8.2); abrupt smooth boundary. (0 to 6 inches thick)

C4—36 to 45 inches; dark brown (10YR 3/3) silt loam, yellowish brown (10YR 5/4) dry; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, sticky and slightly plastic; few very fine roots; few fine pores; moderately calcareous; moderately alkaline (pH 8.2); abrupt irregular boundary. (0 to 9 inches thick)

IIC5—45 to 63 inches; dark brown (10YR 4/3) very gravelly sand, light yellowish brown (10YR 6/4) dry; single grain; loose; 60 percent gravel and 5 percent cobbles; slightly calcareous; moderately alkaline (pH 8.0).

The mollic epipedon is 15 to 20 inches thick. Depth to the seasonal high water table ranges form 30 to 36 inches. Common mottles occur at a depth of about 20 inches. The texture in the layer between depths of 10 and 40 inches is loam with 15 percent or more fine or coarser sand and less than 18 percent clay. A layer of very gravelly sand or loamy sand occurs commonly below a depth of about 40 to 45 inches. Rock fragments are mostly rounded gravel; they make up 0 to 10 percent of the A1 and C1 horizons and 50 to 80 percent of the IIC horizon. Reaction is mildly to moderately alkaline throughout. The soil is slightly to strongly calcareous in the A1 and C1 horizons and noncalcareous to moderately calcareous in the IIC horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 3 moist. The C1 horizon has hue of 10YR or 7.5YR, value of 3 through 6 dry and 2 through 4 moist, and chroma of 2 through 4 dry and moist. This horizon has few to many, fine or medium, faint to prominent yellowish red (5YR 4/6), strong brown (7.5YR 5/6), or yellowish brown (10YR 5/4) mottles. The C1 horizon is stratified silt loam, loam, very fine sandy loam, or sandy loam. The IIC horizon has hue of 10YR or 7.5YR, value of 4 through 6 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 through 4 moist. It is very gravelly sand, loamy sand, sandy loam, or very fine sandy loam with 50 to 80 percent gravel.

Toncana series

The Toncana series consists of deep and very deep, well drained soils formed in materials weathered mostly from a conglomerate of sandstone and quartzite. Toncana soils are on north- and east-facing, very steep mountainsides at elevations of 6,100 to 6,800 feet. Slopes range from 40 to 60 percent. The average annual precipitation is about 22 inches, and the mean annual temperatures is about 43 degrees F.

Toncana soils are similar to Smarts soils. They are near Henhoit, Hoskin, Lucky Star, Norcan, Schuster, and St. Marys soils. Smarts soils have hue of 7.5YR or 10YR in all parts of the B2t horizon. Henhoit and Hoskin soils have a mollic epipedon less than 20 inches thick. Hoskin soils are 24 to 40 inches deep to bedrock. Lucky Star and Schuster soils have somewhat cooler summer temperatures, a mollic epipedon less than 20 inches thick, and an A2 horizon. Norcan soils have a mollic epipedon less than 20 inches thick and have more than 35 percent clay and less than 20 percent rock fragments in the B2t horizon. St. Marys soils have a mollic epipedon less than 20 inches thick and lack a B2t horizon.

Typical pedon of Toncana loam in an area of Toncana loam, 40 to 60 percent slopes, about 1 3/8 miles south and 4 miles east of Morgan County Courthouse, 1,350 feet east and 500 feet north of the southwest corner of section 3, T. 3 N., R. 3 E.:

O1—1 inch to 0; loose leaves and twigs. (0 to 2 inches thick)

A11—0 to 4 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many fine and very fine pores; 10 percent gravel; medium acid (pH 5.8); clear wavy boundary. (3 to 10 inches thick)

A12—4 to 12 inches; dark reddish brown (5YR 3/3) loam, dark brown (7.5YR 4/3) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine and few medium pores; 10 percent gravel; medium acid (pH 5.8); clear wavy boundary. (6 to 10 inches thick)

A13—12 to 24 inches; dark reddish brown (5YR 3/3) loam, dark brown (7.5YR 4/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, common fine, and few coarse roots; many very fine and few fine pores; 20 percent gravel; medium acid (pH 6.0) clear wavy boundary. (8 to 14 inches thick)

B21t—24 to 32 inches; dark reddish brown (5YR 3/4) gravelly clay loam, reddish brown (5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and few fine pores; common thin clay films as bridges and in pores; 40 percent gravel and 10 percent cobbles; medium acid (pH 6.0); gradual wavy boundary. (8 to 19 inches thick)

B22t—32 to 40 inches; dark red (2.5YR 3/6) very gravelly clay loam, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common very fine pores; continuous thin clay films on peds; 35 percent gravel and 20 percent cobbles; medium acid (pH 6.0); clear wavy boundary. (8 to 20 inches thick)

B23t—40 to 60 inches; dark red (2.5YR 3/6) very gravelly clay loam, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few very fine pores; continuous thin clay films on peds; 35 percent gravel and 20 percent cobbles; medium acid (pH 6.0).

The mollic epipedon is 20 to 30 inches thick. The combined thickness of the A1 and B2t horizon is 55 to more than 60 inches over bedrock. The upper 20 inches of the B2t horizon has 30 to 35 percent clay and 35 to 55 percent rock fragments. Base saturation is less than 75 percent in part or all of the soil above a depth of 30 inches. The rock fragments consist of rounded quartzite gravel and cobbles; they make up 0 to 20 percent of the A1 horizon and 35 to 60 percent of the B2t horizon. Reaction is slightly acid or medium acid in the A1 horizon and medium acid in the B2t horizon.

The A1 horizon has hue of 10YR through 5YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and moist. The B2t horizon has dominant hue of 5YR or 2.5YR, but is 7.5YR in the upper part of some pedons. Value is 5 or 6 dry and 3 or 4 moist, and chroma is 4 through 6 dry and 3 through 6 moist. The B2t horizon is gravelly or very cobbly clay loam.

Toone series

The Toone series consists of very deep, well drained soils formed in materials weathered from a conglomerate of sandstone and quartzite, and some gneiss and schist. Toone soils are on very steep mountainsides at elevations of 5,800 to 6,700 feet. Slopes are 40 to 60 percent. The average annual precipitation is about 30 inches, and the mean annual air temperature is about 42 degrees F.

Toone soils are near Hawkins, Ostler, and St. Marys soils. Hawkins soils lack a B2t horizon, have less than 20 percent rock fragments in the layer between depths of 10 and 40 inches, and crack to the surface in late summer months. Ostler soils have a mollic epipedon less than 20 inches thick and have less than 20 percent rock fragments in the B2t horizon. St. Marys soils have a mollic epipedon less than 20 inches thick and lack a B2t horizon.

Typical pedon of Toone loam in an area of Toone loam, 40 to 60 percent slopes, about 2 1/2 miles southwest of Peterson, north of the left-hand fork of Peterson Creek at a point 200 feet south and 500 feet east of the northwest corner of section 14, T. 4 N., R. 2 E.:

O1—2 inches to 0; matted leaves and stems.

A11—0 to 7 inches; very dark brown (10YR 2/2) loam, very dark brown (10YR 2/2) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (7 to 13 inches thick)

A12—7 to 14 inches; very dark brown (10YR 2/2) loam, very dark brown (10YR 2/2) dry; weak coarse subangular blocky structure parting to moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 10 percent gravel; slightly acid (pH 6.2); clear smooth boundary. (7 to 13 inches thick)

A13—14 to 27 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium and coarse subangular blocky structure parting to moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 15 percent gravel; slightly acid (pH 6.4); gradual irregular boundary. (0 to 14 inches thick)

B21t—27 to 37 inches; dusky red (2.5YR 3/2) very cobbly heavy clay loam, weak red (2.5YR 4/2) dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few very fine pores; common thin clay films on peds; 30 percent cobbles and 20 percent gravel; slightly acid (pH 6.4); clear smooth boundary. (4 to 10 inches thick)

B22t—37 to 60 inches; dusky red (2.5YR 3/2) gravelly clay loam, weak red (2.5YR 4/2) dry; moderate medium subangular blocky structure; extremely hard, firm, sticky and plastic; few very fine and fine roots; few very fine pores; common thin clay films on peds; 20 percent gravel and 20 percent cobbles; slightly acid (pH 6.4).

The mollic epipedon is 21 to more than 60 inches thick. The combined thickness of the A1 and B2t horizons is more than 60 inches. Rock fragments consist of sandstone and quartzite cobbles and gravel; they make up 10 to 15 percent of the A1 horizon and 40 to 50 percent of the B2t horizon. Reaction is slightly acid or neutral.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 through 4 dry and 2 or 3 moist, and chroma of 2 or 3 dry and 3 moist. It is loam in the upper part and loam or clay loam in the lower part. The B2t horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 dry and 3 or 4 moist, and chroma of 2 through 4 dry and moist. It is very cobbly or gravelly heavy clay loam or very gravelly light clay.

Trojan series

The Trojan series consists of deep, well drained soil formed in material weathered from phyllite, argillite, schist, and some quartzite. Trojan soils are on nearly level to moderately steep stream terraces and alluvial fans at elevations of 5,100 to 5,700 feet. The slopes range from 0 to 15 percent. Average annual percipitation is about 21 inches, and the mean annual air temperature is about 44 degrees F.

Trojan soils are similar to Brownlee soils. They are near Brownlee, Kahler, and Nicodemus soils. Brownlee soils have a mean annual soil temperature of 47 degrees F or more. Kahler and Nicodemus soils both lack a B2t horizon and have a mollic epipedon more than 20 inches thick. Nicodemus soils have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches.

Typical pedon of Trojan loam in an area of Trojan loam, warm, 0 to 3 percent slopes, in Weber County, about 1 1/2

miles north of Liberty, 1,400 feet east and 1,400 feet north of the southwest corner of section 8, T. 6 N., R. 2 E.:

Ap—0 to 3 inches; dark brown (7.5YR 3/2) loam, brown (10YR 4/3) dry; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary. (3 to 8 inches thick)

A12—3 to 11 inches; dark brown (10YR 3/3) loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure parting to moderate coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few fine pores; 10 percent gravel, slightly acid (pH 6.2); clear smooth boundary. (5 to 13 inches thick)

B21t—11 to 26 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; common very fine and fine roots; few fine pores; many thin and few moderately thick clay films on peds and in pores; 30 percent gravel; slightly acid (pH 6.1); clear smooth boundary. (6 to 15 inches thick)

B22t—26 to 34 inches; brown (7.5YR 4/4) gravelly clay loam, strong brown (7.5YR 5/6) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine and medium pores; common thin and moderately thick clay films on peds and in pores; 30 percent gravel; slightly acid (pH 6.1); clear smooth boundary.

B23t—34 to 50 inches; brown (7.5YR 4/4) gravelly clay loam, strong brown (7.5YR 5/6) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine and medium pores; common thin and moderately thick clay films on peds and in pores; 40 percent gravel; slightly acid (pH 6.1); clear smooth boundary. (0 to 16 inches thick)

C—50 to 60 inches; dark brown (7.5YR 4/4) very cobbly clay loam, strong brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; 40 percent cobbles and 20 percent gravel; slightly acid (pH 6.1).

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1 and B2t horizons is 34 to 50 inches. Rock fragments are gravel and some cobbles; they make up 10 to 20 percent of the A1 horizon, 0 to 35 percent of the B2t horizon, and 35 to 70 percent of the C horizon. The reaction is slightly to medium acid.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 or 4 dry and 2 or 3 moist, and chroma of 3 or 4 dry and 2 or 3 moist. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 through 5 dry and 3 or 4 moist, and chroma of 3 through 6 dry and 2 through 4 moist. It is gravelly clay loam or gravelly loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 dry and 4 moist, chroma of 4 through 6 dry and 2 through 4 moist. It is very cobbly, cobbly, or gravelly clay loam, very gravelly loamy fine sand, or loamy sand.

Utaba series

The Utaba series consists of very deep, well drained soils formed in alluvium from sandstone and quartzite. Utaba soils are on nearly level or gently sloping alluvial fans, stream terraces, or flood plains at elevations of 4,850 to 6,200 feet. Slopes range from 0 to 3 percent. The average annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

Utaba soils are similar to Steed soils. They are near Eastcan, Sunset, and Pringle soils. Steed soils have a mollic epipedon less than 20 inches thick, are calcareous throughout, and have a mean annual soil temperature at a depth of 20 inches of more than 47 degrees F. Eastcan soils have less than 35 percent rock fragments and 18 to 35 percent clay in the layer between depths of 10 and 40 inches. Eastcan soils are calcareous throughout. Sunset soils have a mollic epipedon less than 20 inches thick, have less than 35 percent rock fragments, and have less than 18 percent clay in the layer between depths of 10 and 40 inches. Sunset soils are somewhat poorly drained and have mottles that have chroma of 2 or less at a depth of about 40 inches. Pringle soils have a mollic epipedon less than 20 inches thick and are somewhat poorly drained. They have mottles with chroma of 2 or less above a depth of 20 inches.

Typical pedon of Utaba cobbly loam, about 1 1/4 miles east and 3 1/4 miles north of Croydon, approximately 300 feet east and 300 feet south of the northeast corner of section 3, T. 4 N., R. 4 E.:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) cobbly loam, brown (7.5YR 4/2) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; 25 percent gravel; 20 percent cobbles on the surface; slightly acid (pH 6.4); abrupt smooth boundary. (0 to 8 inches thick)

A12—8 to 17 inches; dark brown (7.5YR 3/2) gravelly sandy loam, brown (7.5YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; few very fine pores; 35 percent gravel; slightly acid (pH 6.4); clear smooth boundary. (4 to 9 inches thick)

A13—17 to 29 inches; dark reddish brown (5YR 3/3) gravelly sandy loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure parting to weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; few very fine pores; 40 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); abrupt wavy boundary. (0 to 13 inches thick)

IIC1—29 to 39 inches; yellowish red (5YR 4/6) very gravelly sand, yellowish red (5YR 5/6) dry; single grained; loose; few fine and very fine roots; 60 percent gravel, 10 percent cobbles; medium acid (pH 5.9); gradual wavy boundary. (7 to 20 inches thick)

IIC2—39 to 60 inches; yellowish red (5YR 4/6) very gravelly sand, yellowish red (5YR 5/6) dry; single grained; loose; 35 percent cobbles and 40 percent gravel; medium acid (pH 5.9).

The mollic epipedon ranges from 20 to 29 inches thick. Depth to the IIC horizon ranges from 20 to 30 inches. The horizon immediately above the IIC horizon is generally gravelly or very gravelly light sandy loam. The mean annual soil temperature at a depth of 20 inches ranges from 45 to 47 degrees F. Rock fragments consist of rounded quartzite and sandstone cobbles and gravel; they make up 25 to 60 percent of the A horizon and 50 to 75 percent of the IIC horizon. Reaction is slightly acid to mildly alkaline in the A horizon and medium acid to mildly alkaline in the IIC horizon.

The A horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is cobbly loam, gravelly loam, or gravelly sandy loam. The IIC horizon has hue of 5YR, 7.5YR, and 10YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 6 dry and 2 through 6 moist. It is very gravelly or very cobbly sand, loamy sand, or very gravelly coarse sandy loam.

Wallsburg series

The Wallsburg series consists of shallow, well drained soils formed in materials weathered from limestone and shale. Wallsburg soils are on the ridges of very steep mountainsides at elevations of 7,000 to 7,800 feet. The slopes are 40 to 60 percent. The average annual precipita-

tion is about 22 inches, and the mean annual air temperature is about 42 degrees F.

Wallsburg soils are similar to Agassiz soils. They are near Cristo and Geertsen soils. Agassiz soils lack a B2t horizon and have less than 35 percent clay throughout. Cristo soils have less than 35 percent rock fragments in the B2t horizon and have bedrock at a depth of 20 to 35 inches. Geertsen soils have less than 35 percent clay in the B2t horizon and have bedrock at a depth of 40 to more than 60 inches.

Typical pedon of Wallsburg gravelly loam in an area of Cristo-Wallsburg complex, 40 to 60 percent slopes, in Morgan County, near the head of Lost Creek, 10 miles north and 1 1/4 miles east of Lost Creek Dam, about 1,000 feet south and 1,840 feet east of the northwest corner of section 23, T. 7 N., R. 5 E.:

A1—0 to 4 inches; dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; loose, friable, slightly sticky and plastic; many very fine and fine and a few medium and coarse roots; 40 percent gravel; slightly calcareous; neutral (pH 7.2); abrupt smooth boundary. (4 to 7 inches thick)

B1—4 to 10 inches; dark grayish brown (10YR 3/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to moderate fine granular structure; slightly hard, firm, sticky and very plastic; many very fine and fine and a few medium and coarse roots; common fine pores; 30 percent gravel; slightly calcareous; neutral (pH 7.2); abrupt smooth boundary. (0 to 7 inches thick)

B2t—10 to 15 inches; dark grayish brown (10YR 4/2) very gravelly heavy silty clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure parting to moderate medium granular structure; hard, firm, sticky and very plastic; few very fine, fine, and medium roots; common fine pores; many moderately thick clay films on peds; 70 percent gravel; noncalcareous; calcareous rock fragments; neutral (pH 7.2); abrupt irregular boundary. (5 to 13 inches thick)

R—15 to 60 inches; platy limestone with roots in fractures.

The mollic epipedon is 7 to 10 inches thick. Depth to bedrock is 15 to 20 inches. Rock fragments are angular gravel and cobbles; they make up 40 to 50 percent of the A1 horizon and 60 to 70 percent of the B2t horizon. Reaction is neutral throughout the soil. The soil is slightly calcareous in the A1 horizon and noncalcareous in the B2t horizon.

The A1 horizon has hue of 10YR, value of 4 or 5 dry and 3 moist, and chroma of 2 or 3 dry and moist. The B2t horizon has hue of 10YR, value of 5 or 6 dry and 4 moist, and chroma of 2 or 3 dry and moist. It is very cobbly heavy clay loam or very gravelly heavy silty clay loam.

Yeates Hollow series

The Yeates Hollow series consists of deep, well drained soils. They formed in materials weathered mainly from a conglomerate of sandstone and quartzite, but in places some schist, phyllite, and argillite materials are present. Yeates Hollow soils are on east-, south-, and west-facing mountainsides, benches, alluvial fans, stream terraces, and mountain foot slopes. Slopes are 2 to 70 percent, and elevations are 5,100 to 7,400 feet. The average annual precipitation is about 22 inches, and the mean annual air temperature is about 44 degrees F.

Yeates Hollow soils are similar to Durfee, Manila, and Ostler soils. They are near Donner, Henefer, Manila, and Smarts soils. Durfee soils are very deep, and the clay content in the B2t horizon does not decrease by as much as 20 percent of the maximum clay content to a depth of 60 inches. Manila, Ostler, and Henefer soils all have less than 35 percent rock fragments in the upper 20 inches of the B2t horizon. Henefer and Smarts soils have a mollic epipedon more than 20 inches thick. Donner soils are less than 35 percent rock fragments and less than 35 percent clay in the B2t horizon and have weathered bedrock at a depth of 23 to 40 inches. Smarts soils lack a B2t horizon and have less than 35 percent clay in the layer between depths of 10 and 40 inches.

Typical pedon of Yeates Hollow very stony loam in an area of Yeates Hollow-Smarts complex, 30 to 70 percent slopes, in Weber County, 3/4 mile east and 1 3/4 mile north of Patio Spring on Wolf Creek, 1,000 feet north and 500 feet east of the southwest corner of section 11, R. 7 N., R. 1 E.:

O1—1 inch to 0; matted leaves, twigs, etc. (Covers about 90 percent of surface.)

A1—0 to 13 inches; very dark brown (7.5YR 2/2) very stony loam, brown (7.5YR 4/2) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; 40 percent cobbles and gravel; slightly acid (pH 6.2); gradual wavy boundary. (0 to 9 inches thick)

B21t—13 to 19 inches; brown (7.5YR 4/4) cobbly clay loam, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; very hard, firm, sticky and very plastic; few fine, medium, and coarse roots; many fine and very fine and few medium pores; 35 percent cobbles and gravel; slightly acid (pH 6.1); gradual wavy boundary. (5 to 10 inches thick)

B22t—19 to 29 inches; yellowish red (5YR 4/6) cobbly heavy clay loam, light reddish brown (5YR 6/4) dry; weak medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few medium and coarse roots; many fine and very fine and few medium pores; many thin clay films on peds; 35 percent cobbles and gravel; slightly acid (pH 6.1); gradual irregular boundary. (5 to 14 inches thick)

B23t—29 to 42 inches; yellowish red (5YR 4/6) very cobbly heavy clay loam, light reddish brown (5YR 6/4) dry; ped size and shape determined by space available between rock fragments; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; many fine and very fine and a few medium pores; many thin clay films on peds; 75 percent cobbles and gravel; slightly acid (pH 6.1); abrupt irregular boundary. (0 to 27 inches thick)

R—42 inches; fractured bedrock with B2t material (as described above) in cracks.

The mollic epipedon is 10 to 19 inches thick. The combined thickness of the A1 and B2t horizon is 40 to more than 60 inches over bedrock or extremely rocky material. The rock fragments are mixed gravel, cobbles, and stones of quartzite and sandstone; they make up 15 to 60 percent of the A1 horizon and 35 to 70 percent of the B2t horizon. Reaction is slightly acid to neutral in the A1 horizon and medium acid to slightly acid in the B2t horizon.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. It is very stony, very cobbly, very gravelly, cobbly, or gravelly loam, loam, very cobbly clay loam, or cobbly silt loam. The B2t horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 or 6 dry and 3 through 6 moist, and chroma of 3 through 6 dry and 3 through 8 moist. It is cobbly, very cobbly, or gravelly heavy clay loam, clay, cobbly or gravelly heavy silty clay loam, or very gravelly sandy clay.

Yeljack series

The Yeljack series consists of deep, well drained soils formed in materials weathered from sandstone and some conglomerate. Yeljack soils are on strongly sloping to steep mountainsides at elevations of 6,500 to 8,500 feet. Slopes range from 6 to 30 percent. The average annual precipitation is about 30 inches, and the mean annual air temperature is about 41 degrees F.

Yeljack soils are near Charcol, Ercan, and Lucky Star soils. Charcol soils have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches and in the B2t horizon. Ercan soils have a mollic epipedon less than 20 inches thick. Lucky Star soils have a mollic epipedon less than 20 inches thick and have more than 35 percent rock fragments in the layer between depths of 10 and 40 inches and in the B2t horizon.

Typical pedon of Yeljack loam in an area of Yeljack loam, 6 to 15 percent slopes, about 10 miles north of Lost Creek Dam, 700 feet north and 800 feet west of the southeast corner of section 17, T. 7 N., R. 5 E.:

A11—0 to 6 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/4) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and few medium roots; slightly acid (pH 6.2); clear smooth boundary. (5 to 12 inches thick)

A12—6 to 22 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; slightly acid (pH 6.2); gradual wavy boundary. (10 to 20 inches thick)

B1—22 to 34 inches; reddish brown (5YR 4/3) very fine sandy loam, yellowish red (5YR 4/6) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; many very fine pores; slightly acid (pH 6.3); clear irregular boundary. (4 to 12 inches thick)

B21t—34 to 43 inches; dark red (2.5YR 3/6) sandy clay loam, red (2.5YR 4/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many fine and very fine pores; common thin clay films on peds; 10 percent cobbles and 5 percent gravel; noncalcareous; some coatings of lime on rock fragments; neutral (pH 7.3); gradual irregular boundary. (9 to 13 inches thick)

B22t—43 to 60 inches; dark red (2.5YR 3/6) sandy clay loam, red (2.5YR 4/6) dry; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many fine and very fine pores; common thin clay films on peds; 10 percent cobbles, 5 percent gravel; slightly calcareous; coatings of lime on rock fragments; neutral (pH 7.3).

The mollic epipedon ranges from 20 to 32 inches thick. The combined thickness of the A1, B1, and B2t horizons ranges from 45 to more than 60 inches. Some pedons are underlain by bedrock at a depth of 55 to more than 60 inches. Rock fragment content is less than 20 percent throughout the soil. Reaction is medium acid to neutral.

The A1 horizon has hue of 10YR through 5YR, value of 3 through 5 dry and 2 or 3 moist, and chroma of 2 through 4 dry and 2 or 3 moist. The B1 horizon has hue of 7.5YR through 2.5YR and value of 4 through 7 dry and 3 through 6 moist. It is very fine sandy loam or loam. The B2t horizon has hue of 5YR or 2.5YR and value of 4 through 8 dry and 4 through 6 moist. It is sandy clay loam, clay loam, cobbly clay loam, or silty clay loam. The B2t horizon is noncalcareous to moderately calcareous.

Yence series

The Yence series consists of deep, well drained soils formed in glacial till from a conglomerate of sandstone and quartzite deposited over sandstone and material weathered from the sandstone. Yence soils are on undulating and rolling high mountaintops. Slopes are 3 to 15 percent. The elevations are 7,000 to 9,000 feet. The average annual precipitation is about 30 inches, and the mean annual air temperature is about 41 degrees F.

Yence soils are near Herd and Richens soils. Herd soils have less than 20 percent rock fragments in the B2t horizon. Richens soils have a mollic epipedon and less than 20 percent rock fragments in the B2t horizon.

Typical pedon of Yence extremely stony loam in an area of Herd-Yence complex, 3 to 15 percent slopes, about 5 1/2 miles north and 4 miles west of Croydon at a point about 200 feet north and 1,040 feet west of the southeast corner of section 22, T. 5 N., R. 3 E:

A11—0 to 2 inches; dark reddish brown (5YR 3/3) extremely stony loam, brown (7.5YR 4/4) dry; weak medium subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; common fine and few coarse roots; 35 percent gravel and 10 to 25 percent stones; slightly acid (pH 6.3); abrupt wavy boundary. (2 to 4 inches thick)

A12—2 to 9 inches; dark reddish brown (5YR 3/3) very gravelly loam, brown (7.5YR 4/4) dry; weak medium subangular structure; soft, friable, slightly sticky and slightly plastic; common fine and few coarse roots; few fine and medium pores; 60 percent gravel and cobbles; slightly acid (pH 6.4); clear wavy boundary. (4 to 11 inches thick)

B1t—9 to 16 inches; reddish brown (5YR 4/4) very gravelly sandy clay loam, yellowish red (5YR 5/6) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; few fine and medium roots; common fine and medium pores; 60 percent gravel and cobbles; evidence of clay stripping on peds; neutral (pH 6.6); diffuse wavy boundary. (4 to 10 inches thick)

B21t—16 to 23 inches; dark red (2.5YR 3/6) very gravelly heavy clay loam, yellowish red (5YR 5/6) dry; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; common very fine and fine pores; few thin clay films on peds; 60 percent gravel and cobbles; medium acid (pH 6.0); abrupt wavy boundary. (6 to 9 inches thick)

B22t—23 to 33 inches; red (2.5YR 4/6) cobbly clay, red (2.5YR 5/6) dry; moderate coarse angular blocky structure; extremely hard, extremely firm, sticky and very plastic; few fine roots; few very fine and fine pores; continuous moderately thick clay films on peds; 40 percent cobbles and gravel; slightly acid (pH 6.2); clear irregular boundary. (7 to 14 inches thick)

B3t—33 to 42 inches; yellowish red (crushed) (5YR 4/6) very cobbly heavy clay loam, reddish yellow (5YR 6/8) dry; aggregate reddish yellow (5YR 6/8) and light yellowish brown (10YR 6/4) dry; moderate coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few very fine and fine pores; few thin clay films on peds; 40 percent cobbles and gravel; medium acid (pH 5.6). (11 to 14 inches thick)

R—42 inches; sandstone.

The combined thickness of the A1, B1t, B2t, and B3t horizons ranges from 40 to 60 inches or more over bedrock. Rock fragments consist of rounded quartzite gravel, cobbles, and stones; they make up 20 to 60 percent of the A1 horizon and 40 to 70 percent of the B2t horizon. Reaction is slightly acid or neutral in the A1 and B1t horizons and medium acid through neutral in the B2t and B3t horizons.

The A1 horizon has hue of 5YR through 10YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 through 4 moist. Only

the upper 4 to 9 inches has moist color value of less than 4 after mixing. The A1 horizon is extremely stony or very stony loam in the upper part and very gravelly or gravelly loam or very cobbly sandy loam, very cobbly loam, or very cobbly silt loam in the lower part. The B2t horizon has hue of 10R through 5YR, value of 3 through 6 dry and 3 through 5 moist, and chroma of 4 through 8 dry and 4 through 6 moist. It is very gravelly, cobbly, very cobbly, or gravelly heavy clay loam or clay.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 15, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature régime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

This section describes how the factors of soil formation have affected the formation of soils in the survey area.

The characteristics of a soil at any given point are determined by the parent material; the climate under which the soil material accumulated and has existed since accumulation; the relief, or topography, which influences the local or internal environment of the soil and its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; the biological forces, or the plants and animals living on or in the soil, that have acted upon the soil material; and the length of time the climatic and biological forces have acted on the soil material.

The soils in the survey area show the interaction of all five factors of soil formation.

Parent material

The soils on the flood plains, recent alluvial fans, valley bottoms, stream terraces, and lake terraces in the survey area formed in transported alluvium. This parent material was derived dominantly from quartzite, sandstone, limestone, argillite, phyllite, and schist rocks. It was deposited in Morgan Valley, Ogden Valley, and Lost Creek drainage during the high water levels of old Lake Bonneville. Some of these deposits were later moved, sorted, and deposited again, forming lake terraces as the water receded.

Pringle, Nicodemus, Steed, and Utaba soils formed in coarse textured, gravelly and cobbly alluvium deposited near the mouth of canyons and adjacent to the major streams in the survey area. Canburn and Crooked Creek

soils formed on valley bottoms in medium and fine textured sediment. The Eastcan and Sunset soils formed in stratified medium textured and moderately coarse textured alluvium on flood plains. The Sunset soils have a coarse textured, gravelly and cobbly deep underlying layer. The Redola and Phoebe soils formed in coarse textured alluvium on alluvial plains and stream terraces.

Brownlee, Broadhead, Nebeker, Parlo, and Parleys soils formed on stream terraces and high lake terraces. Broadhead and Nebeker soils formed in fine textured soil materials. Brownlee, Parleys, and Parlo soils formed in moderately fine textured materials. Trojan, Stoda, and some Manila soils formed on the high lake terraces and on the escarpment between lake terraces. The Manila soils formed in the fine textured sediments and the Trojan and Stoda soils formed in the medium textured and moderately fine textured materials. The Kahler and Lamondi soils formed in gravelly and cobbly alluvium on high alluvial fans, mainly in Ogden Valley. The alluvium was derived from argillite, phyllite, and schist rocks.

In the mountainous areas, mainly above old Lake Bonneville, the parent material was derived from Precambrian and Tertiary rocks. Tuffaceous sandstone, tuff, and limestone are the principal source of parent material for Bertag, Hawkins, and Ostler soils. These soils formed in fine textured materials and have high shrink-swell potential. The Hawkins soils have cracks that open and close each year and extend from the surface to a depth of 30 inches or more. Causey, Choptie, Collinston, and Richville soils also formed in this parent material. These soils formed mainly in medium textured materials. Soils from this parent material are well drained and range from shallow to very deep. The Donner soils are also influenced by both andesite and tuffaceous sandstone.

The conglomerate of red sandstone and quartzite of the Wasatch Formation is a primary source of parent materials for Charcol, Condie, Flygare, Henhoit, Holmes, Hoskin, Lucky Star, Moweba, Schuster, St. Marys, and Toncana soils. These soils range from moderately deep to very deep. They are well drained and free of carbonates and generally have color hue of 7.5YR or redder below the A horizon. More than 35 percent of the control section of these soils is rounded gravel, cobbles, or both.

The red sandstone portion of the Wasatch Formation is the primary source of fine textured parent materials in which Henefer, Mondey, Morgala, Norcan, Manila, and Sessions soils formed. The Morgala and Norcan soils have a deep and strongly developed argillic horizon and are probably the oldest soils in the survey area. They have a B2t horizon that extends to a depth of 60 inches or more. All of these soils are very deep and well drained. Durfee, Scave, Yeates Hollow, and Toone soils formed mainly from sandstone. They have more than 35 percent rounded gravel or cobbles in the control section and are also fine textured. The Bullnel, Guilder, Ercan, Etchen, Redcan, and Yeljack soils also formed in materials weathered from red sandstone. They are medium textured and moderately fine textured. Some of these soils have angular sandstone rock fragments throughout the profile.

The Herd, Yence, and Richens soils formed in glacial till or in glacial till and residuum from the underlying red sandstone.

Hades, Isbell, Kilfoil, and Croydon soils formed in materials weathered from grey sandstone. These soils are medium textured and moderately fine textured. Some of these soils have angular sandstone throughout the profile.

The Durst and Foxol soils and a moderately deep Smarts soil formed in materials weathered mostly from quartzite. These soils are shallow to deep and have angular quartzite gravel or cobbles throughout the profile.

The Agassiz, Horrocks, Burgi, Cristo, Caballo, Geertsen, and Wallsburg soils formed in material weathered mostly from limestone and interbedded shale and limestone. These soils are shallow to very deep. The materials that weathered principally from limestone have more than 35 percent angular gravel and cobbles throughout the profile and are medium textured or moderately fine textured. The Cristo and Wallsburg soils are influenced more by shale and are fine textured. The Wallsburg soils also have more than 35 percent angular gravel and cobbles throughout the profile.

The Broad Canyon, Cloud Rim, Nagitsy, Patio, Poleline, Nordic, and Smarts soils formed in materials weathered from argillite, phyllite, schist, gneiss, and some quartzite. The Cloud Rim soils are moderately fine textured. The Broad Canyon, Nagitsy, Patio, Poleline, Nordic, and Smarts soils are medium textured or moderately fine textured and have more than 35 percent rock fragments throughout the soil profile.

Climate

The climate in the survey area ranges from moist subhumid at the lower elevations to humid at the higher elevations. The temperature and moisture effects are influenced by exposure and elevation. In places the available moisture at a lower elevation on northerly exposures is similar to that on southerly exposures 500 to 1,000 feet higher in elevation.

The influence of climate is expressed mainly in the amount of organic matter accumulation in the surface layer, the translocation of minerals and clays, and the formation of distinct soil horizons.

Highest precipitation occurs in the fall, winter, and early spring. The water is stored in the soil or percolates through it. Percolation has removed soluble salts from the soils on the high lake terraces, high fans, and mountains. In the areas of higher precipitation (18 to 22 inches) carbonates either have been translocated to form distinct lime horizons or have been leached from the soil.

Following or accompanying the leaching of carbonates some silicate clay has been translocated. Clay is formed in place by alteration of minerals and an argillic horizon forms.

The soils on the stream terraces, alluvial plains, and valley bottoms receive runoff from higher areas and in some places receive additional moisture from upward-

moving ground water. In places this additional moisture has caused a high water table and impaired drainage. Crooked Creek and Canburn soils are examples of soils that formed under these conditions. These soils are dark colored and mottled and have a high water table.

Parleys and Stoda soils formed on the high lake terraces and contain distinct horizons of lime accumulation.

At an elevation of 5,200 feet, the highest level of old Lake Bonneville, annual precipitation is about 20 inches. Manila, Yeates Hollow, Mondey, Ostler, Durfee, Guilder, Isbell, Horrocks, and Hoskin soils generally occur on south- or west-facing slopes and have a thin A1 horizon. On north- and east-facing slopes at this elevation are Bertag, Henefer, Moweba, and Toncana soils. These soils have a thick, dark A1 horizon, and the organic matter accumulation extends to a depth of 20 inches or more. The soluble carbonates in these soils are leached to a depth of 60 inches or more.

The Guilder, Etchen, Bullnel, and Redcan soils are at 5,400 to 8,200 feet elevation and receive about 20 inches annual precipitation. These soils formed in materials weathered mostly from red sandstone. These soils have a very thin, reddish A1 horizon, a weakly to moderately developed B2t horizon, and horizons of lime accumulation. Parent materials, climate, and soil erosion have influenced the A1 horizon of these soils.

In the area of highest precipitation (22 to 40 inches), percolation has removed much of the soluble salts and minerals and has translocated silicate clays. A light colored, bleached A2 horizon and a moderately or strongly defined B2t horizon have formed in the Lucky Star, Ercan, Richens, and Charcol soils. Carbonates and soluble salts have mostly been leached from the soil.

Climate also influences the soils in the survey area through differences in the kind and amount of vegetation produced. In the moist subhumid climate the vegetation is mainly shrubs, forbs, and grasses. The vegetation in the humid climate is mainly aspen, conifers, and associated understory species.

Relief

Relief, or landform, affects soil formation principally by its influence on runoff, drainage, and microclimate. Steepness of slope and direction that the slope faces are important in soil formation.

The dominant landforms, or topographic features, in the survey area are valley bottoms, stream terraces, and alluvial plains; lake terraces and terrace escarpments; and foothills, mountains, and high mountains.

The Crooked Creek and Canburn soils occur on valley bottoms. These soils have a high water table. The soils are generally mottled throughout the profile. Wetness and organic matter content of the soils cause reduction and transfer of iron. A fluctuating water table causes air to oxidize the iron and produces yellowish brown, brown, or yellowish red mottles. If the air oxygen is severely restricted by the water, the iron is reduced and the soil material is gray or olive gray in color. Water-loving plants produce an abundant supply of organic matter, so the surface layer is more than 20 inches deep and is grayish brown, dark grayish brown, or dark gray in color.

The Pringle, Eastcan, and Sunset soils also occur on the alluvial plains of permanent streams. The water table in these soils fluctuates, and they have mottles in the profile. In places these soils are subject to stream overflow. These soils are somewhat poorly drained to moderately well drained. The well drained Redola, Utaba, Steed, and Phoebe soils also occur on the alluvial plains and stream terraces. All of these soils formed in recent alluvium and only an A1 horizon is evident.

The lake terraces and terrace escarpments of prehistoric Lake Bonneville are prominent landforms along the edges of Morgan Valley and Ogden Valley. The Parleys and Stoda soils are dominant on these terraces. An A1 horizon and horizons of lime accumulation are present in the Stoda soils. The Parleys soils have A1 and B2t horizons and horizons of lime accumulation.

The foothill and mountain areas consist mostly of steep and very steep mountainsides and small intervening valleys and ridges. Also included are some sloping or moderately sloping foothills, fans, and stream terraces. The mountains surrounding Ogden Valley and Morgan Valley rise abruptly from the high lake terraces. The elevation is 5,135 to about 9,800 feet. The steep mountain slopes cause differences in climate. Steep south- and west-facing slopes are warmer and dryer than the north- and east-facing slopes. Snow melts more rapidly, water runs off readily, and evaporation losses are higher on south- and west-facing slopes. North- and east-facing slopes are cooler, evaporation is less, and more of the precipitation enters the soils. Thus water percolates deeply into these soils, leaching soluble salts and clay from the A horizon and transporting them to accumulate in deeper horizons. The vegetative cover is composed of different kinds of plants and is more dense on the north- and east-facing slopes than on south- and west-facing slopes at the same elevation.

The Bertag, Smarts, and Moweba soils are on northern exposures mostly under a dense cover of maple or shrubs. They have a thick, dark A1 horizon, and carbonates are leached to a depth of 60 inches or more. The Causey, Patio, and St. Marys soils are at similar elevations but are on south-facing slopes under a cover of shrubs and grasses. They have a thinner A1 horizon and a thinner solum than soils on north- and east-facing slopes.

Douglas-fir, alpine fir, and aspen are the dominant trees on the steep and very steep, north- and east-facing high mountainsides. At the highest elevations, aspen and conifers also grow on southern and western exposures. The soils on these very steep mountainsides have a mean summer soil temperature of less than 59 degrees F at a depth of 20 inches. The Condie soils that formed under conifers are extensively leached and are mainly medium to slightly acid in reaction. They have a thin organic horizon; a thin, dark-colored A1 horizon; and a thick,

bleached A2 horizon over a moderately developed B2t horizon. The Lucky Star, Ercan, and Flygare soils that formed under aspen have a thick, dark-colored A1 horizon, a bleached A2 horizon, and a moderately developed B2t horizon.

Plants and animals

Plants strongly influence the kind, amount, and position of organic matter incorporated into soils. Living organisms influence soil structure and porosity and thus influence the rate of air and water movement through the soil. Plants and animals mix the soil and retard horizon formation in places. The decay of forest litter produces acids. These acids in the soil solution hasten the leaching processes, so bases are leached readily from the soil.

Reeds, sedges, and wiregrass on the wet flood plains and valley bottoms contribute large amounts of organic matter on the Canburn and Crooked Creek soils. These soils have a dark grayish brown, grayish brown, or dark gray, thick A1 horizon.

On the semiwet alluvial plains and stream terraces, the dominant vegetation is Kentucky bluegrass, bunchgrasses, narrowleaf cottonwood trees, willow, river birch, and sagebrush. The narrowleaf cottonwood, willow, and river birch are near the streams and in wetter areas, and the sagebrush increases with increasing distance from the streams. The moderately well drained Eastcan and somewhat poorly drained Sunset and Pringle soils occur in these areas. These soils receive fresh sediments at irregular intervals. The organic matter in these soils generally does not decrease uniformly with depth.

On the higher stream terraces and the lake terraces, the dominant vegetation is bluebunch wheatgrass, western wheatgrass, muttongrass, tall native bluegrass, basin wildrye, and other perennial grasses and a small amount of sagebrush, bitterbrush, and snowberry. This vegetation produces soils with a very dark grayish brown, dark grayish brown, or dark brown surface layer that is 7 to 20 inches deep, and is leached of carbonates. These soils have moderate structure if they have a B2t horizon. The soils are well drained. The main soils that formed under grass are the Parleys, Stoda, and Nebeker soils.

The mountainous areas have a wide variety of vegetation. Maple is dominant in the northwestern part of the survey area, and oak is dominant in the southern part. Maple occurs mainly on the north- or east-facing mountainsides on Bertag or Smarts soils. These soils have a thick, dark colored A1 horizon. Oak occurs mainly on Henhoit, Horrocks, Schuster, Ostler, Norcan, Cloud Rim, and Morgala soils. These soils have a dark colored, thin A1 horizon.

In some of the mountainous areas the dominant vegetation is woody species, such as bitterbrush, big sagebrush, yellowbrush, serviceberry, and snowberry, and an understory of bluebunch wheatgrass, muttongrass, and Basin wildrye. The Manila, Yeates Hollow, Guilder, Isbell, Kilfoil, St. Marys, Henefer, Hades, Durst, and Durfee soils are the main soils under this vegetation. Hades and Henefer soils occur on the north-facing slopes, which produce greater amounts of vegetation. They also have a thicker A1 horizon than the soils on south-facing slopes.

On the high mountainsides, aspen occurs on the north- and east-facing slopes at the lower elevations and on other exposures at the higher elevations. Generally, aspen trees are in open stands and have a dense understory of mountain brome, blue wildrye, slender wheatgrass, snowberry, and bluebells. Dominant under aspen are the Lucky Star, Flygare, Ercan, and Scave soils. These soils have a dark brown, very dark brown, or very dark grayish brown, thick A1 horizon, a distinct A2 horizon, and a moderate B2t horizon. Charcol soils are presently associated with the Lucky Star soils and have the same horizon sequence as the Lucky Star soils, but they have a thicker A1 horizon than the Lucky Star soils.

Time

The kinds of horizons and the degree of their expression depend on the length of time soil-forming processes have been active on the parent materials. The amount of time varies from a few years to centuries.

The soils on alluvial plains, such as those of the Eastcan, Pringle, Utaba, Steed, and Redola series, have the least degree of horizon differentiation. They receive additional sediments during each flood. Some organic matter has accumulated in their surface layer to form an A1 horizon, but other horizon differentiation has not occurred.

Prehistoric Lake Bonneville receded to its present level of Great Salt Lake probably between 30,000 and 23,000 years ago. Since then soluble salts have been leached from the profiles of the well drained soils on the lake terraces in Ogden Valley and Morgan Valley. Soils formed in moderately or slightly calcareous parent materials have had the carbonates leached from the A1 and B2 horizons and deposited in lower horizons. Also some clay particles have been translocated from the A1 horizon to form an argillic B2t horizon. The clay particles occur as thin films on ped surfaces, as in the Parleys soils.

Soils with the strongest expression of horizons, and probably the oldest soils, are in the Henefer, Lucky Star, Condie, and Ercan series. These soils formed in material weathered from sandstone or conglomerate of sandstone and quartzite that was low in carbonates. Henefer soils are under grass and shrub vegetation. The Henefer soils have a thick, dark A1 horizon and a thick, reddish brown, moderately developed B2t horizon. The Lucky Star and Ercan soils have a thick, dark grayish brown or grayish brown A1 horizon; a thick, slightly acid, sandy loam A2 horizon; and a medium acid B2t horizon.

General nature of the area

This section gives general information concerning the survey area. It discusses settlement, natural resources, farming, and climate.

Settlement of the area

The Shoshonean culture seems first to have appeared in the western half of the Great Basin and to have spread eastward, perhaps 500 to 600 years ago. The Shoshoni proper occupied Morgan County and the eastern part of Weber County in the Wasatch Mountains.

As early as 1706, French traders may have drifted into this area and shifted from one Indian tribe to another. The journals of Lewis and Clark indicate that by 1805 the Spanish traders had extended their operations all through the northern part of Utah, including Morgan County and the eastern part of Weber County.

In July 1846, the first contingent of Latter-Day Saint pioneers (Mormons) travelled through Morgan County led by Brigham Young.

The town of Milton, located about five miles west of Morgan City, was the first settlement in Morgan County. It was first settled in 1852. Other small towns settled in the early history of Morgan County are Littleton, Richville, Porterville, South Morgan, Croydon, North Morgan, and Stoddard. Other small communities are Peterson, Enterprise, and Mountain Green. Morgan County was organized in 1862.

Summer recreation has been given great impetus by the building and enlargement of Lost Creek and East Canyon Reservoirs. During the 1960's the county began to change from the rural farm atmosphere to one of rural subdivision.

The county population was 2,519 in 1950, 2,837 in 1960, and 3,983 in 1970. The county seat is at Morgan City, the largest and most populous place in the county. Its population is about 1,600. Interstate 80 north and the Union Pacific Railroad line from Ogden to Denver traverse Morgan County.

Ogden Valley, in the eastern part of Weber County, was originally hunting grounds of the Shoshoni Indians. It is supposed that Peter Skeen Ogden and his party of fur trappers were the first white men to visit the area during or before 1826. During the following two decades trapping flourished.

In 1856 a herd of cattle was taken to Ogden Valley from the Ogden city area by way of North Ogden Canyon. To some extent the settlement of Ogden Valley was delayed because of the desire of the residents of Ogden and neighboring communities to use the valley for grazing of livestock during the summer months.

The first settlement in Ogden Valley was made at a point three miles northwest of the present site of Eden. Eden was settled in 1866.

During the fall of 1860 seven families located approximately one-half mile south of the present town of Huntsville. This settlement expanded gradually to include the area now occupied by Huntsville, which is the largest community in the valley.

Liberty, the third community in Ogden Valley, is located four miles northwest of Eden. The community is largely an outgrowth of Eden.

Development of the Ogden Valley was slow from the 1860's to the early 1960's. Beginning in the late 1930's with the development of a ski resort at Snow Basin, recreational development began to influence the future of Ogden Valley. Later, two additional ski resorts were developed in the area, and a new country club at Patio Springs added to the trend. Summer recreation was given impetus by the building of Pineview Reservoir and Causey Reservoir.

During the 1960's Ogden Valley began to change from the rural farm atmosphere to one of rural subdivisions and summer season home development. This change has brought about increased population growth.

Population was 1,536 in 1960, 2,148 in 1970, and 2,575 in 1975. The largest community is Huntsville, with a population of 550.

Natural resources

Ranching is the principal industry in this survey area. Livestock graze the grasslands, and farms produce crops that support the livestock industry.

In most of the survey area, water is adequate for both domestic and livestock use. Ogden Valley, filled with more than 600 feet of sedimentary deposits during the existence of prehistoric Lake Bonneville, provides the culinary water for the city of Ogden.

Morgan County's largest industrial enterprise is a cement plant located at Devils Slide. It uses the Twin Creek Limestone and Nugget Sandstone geologic formations in the production of cement.

The mountainous lands of the survey area are important watersheds. Pineview Reservoir, Causey Reservoir in eastern Weber County, and Lost Creek Reservoir and East Canyon Reservoir in Morgan County serve as storage and regulatory reservoirs on the main streams of the area. This water is used for irrigation in Morgan Valley and Ogden Valley and also for lands in Davis and lower Weber Counties.

Morgan County and eastern Weber County are well known as a sportsman's recreation area. Each summer fishermen frequent the Ogden River, Weber River, Lost Creek, and East Canyon Creek and their tributaries. The large reservoirs in the survey area are popular for fishing, water skiing, or boating. Each fall deer and elk are hunted in the mountainous lands. Permits are also issued for moose in the South Fork of the Ogden River.

Some Douglas-fir and white fir are harvested each year. Sawmills were set up near the timber stands during early settlement years and rough-sawn timber hauled out of the mountains. In recent years the harvested trees have been hauled to various sawmills outside the survey area.

Aside from the beautiful canyons and majestic peaks in the survey area, Morgan County's most noted attractions are China Town and Devils Slide. Devils Slide is adjacent to Interstate 80 north and is viewed by thousands of tourists each year as they travel through the county.

Farming

The first settlers in the survey area were mainly sheep or cattle ranchers. At one time potatoes, peas, sugar beet seed, hay, grain, and pasture were important crops in the Morgan and Ogden Valleys. Cabbage was an important cash crop in Morgan Valley. Potatoes, peas, sugar beet seed, and cabbage are no longer produced because of unfavorable marketing and economic conditions. Hay, grain, and pasture are now the principal crops grown. Dairy cattle, sheep, and beef cattle are the main livestock raised.

Mink ranching is a large enterprise in Morgan County. The climate is favorable for producing prime pelts in many beautiful shades. Some of the finest mink fur in the world is produced in Morgan Valley.

In places the soils on the alluvial plains, valley bottoms, and stream terraces have a high water table and are subject to frost damage late in spring and early in fall. These limitations restrict the crops that can be grown. Yields of small grains and alfalfa are reduced. The principal management needs are control of erosion and improved management of irrigation water.

Supplemental irrigation is necessary on cultivated land in the Morgan Valley and Ogden Valley to produce maximum crop yields. Consequently, irrigation water is used wherever it is available. The first settlers organized irrigation companies to construct diversions and canal systems. The canals were mainly diverted from the major streams. Irrigation water was dependent largely on natural stream flow. Since about 1950 new reservoirs have been constructed and others enlarged as part of the Weber Basin Project. Pineview and East Canyon dams were enlarged. The reservoirs behind these dams have capacities of 110,100 and 48,100 acre-feet respectively. Lost Creek and Causey dams have been constructed. The reservoirs behind these dams have capacities of 20,000 and 6,900 acre-feet respectively. These reservoirs store sufficient water to provide a dependable water supply and to irrigate additional acreage in Weber, Morgan, and Davis Counties.

Many irrigation companies are piping streams to conserve water and reduce maintenance. Sprinkler irrigation is replacing flood, furrow, or border methods on some farms. Sprinkler irrigation, properly managed, conserves water and increases irrigation efficiency.

The area used for nonirrigated crops is mainly in the western portion of Morgan Valley and around the edges of Ogden Valley. These areas are generally on high terraces and mountain foot slopes or rolling hills.

Snow Basin ski area, located in eastern Weber County, is in a basin originally called Wheeler Basin. In the early days, this basin was heavily used for grazing and was logged. In 1926 a flood began in Wheeler Basin, partly due to the deteriorated range condition. After this, the city of Ogden purchased the land and transferred it to the Forest Service for supervision.

The Weber River Demonstration Project was initiated by the Soil Conservation Service in September 1936. These demonstrations were a success and the Morgan Soil Conservation District was organized in October 1938. In 1940 and 1941 two additions were made to the district by petition, and now the district contains all of the privately owned lands in Morgan County, about 95 percent of the county. The Forest Service, Bureau of Land Management, and Bureau of Reclamation supervise the remaining 5 percent.

The Ogden Valley Soil Conservation District was organized in 1943. It includes all of the lands of the Ogden River drainage east of the city of Ogden, Utah.

About 95 percent of the survey area is used for grazing by sheep and cattle. Irrigated alfalfa hay and grain are used principally for supplemental feed in the livestock enterprises. Hereford is the principal breed of cattle but other breeds are also raised.

Dairy herds are mostly of the Holstein breed. There are also a few herds of Jersey cattle. The milk is shipped to Ogden for processing.

Sheep are an important part of the livestock industry in both Weber and Morgan Counties. Most of the rangeland is mountainous and too steep for efficient use by cattle. Therefore, the rangeland is used mostly by sheep. They are raised both for meat and wool. Most of the lambs and wool are sold to feeders or packers outside the survey area. Sheep herds are mostly wintered on the desert ranges in western Utah and eastern Nevada.

Although the economy of the survey area is based largely on the grazing of livestock, recreation and urban developments are gaining in importance.

Climate

E. ARLO RICHARDSON, climatologist, Utah State Department of Agriculture, helped to prepare this section.

The survey area is composed of a series of canyons and small valleys surrounded by mountains ranging from 8,000 to nearly 10,000 feet above sea level. The bottoms of the lower valleys range in elevation from 5,000 to 6,000 feet above sea level with only narrow canyon openings supplying drainage into the Great Salt Lake Basin. Air cooled by strong radiation from the mountain slopes tends to collect and pool in the wider portions of the lower valleys, and as a result relatively strong temperature inversions persist throughout much of the cooler portion of the year.

The area enjoys a semiarid continental climate (table 16). Average annual precipitation in the lower valleys is as low as 15 inches a year in the rain shadow of the higher mountains to over 40 inches a year at higher elevations.

The principal rainfall season extends from October to May, when storms from the Pacific Ocean frequent the region. Precipitation is quite evenly distributed during this period, with 1 to 2 inches on the average during each of these months. Precipitation during June through September is usually associated with summer thunderstorms. These storms are extremely variable in intensity and location and occasionally produce heavy downpours of rain which result in local flash flooding.

Hail, although normally small in size, occasionally causes some damage to crops and property during spring and summer.

Great variability can be expected in each month's precipitation. Especially striking is the variation in annual totals. Annual accumulations in the valley bottoms have ranged from less than 10 inches in some years to nearly 45 inches in others.

Snowfall, like the other climatic factors, is strongly influenced by topography. Even in the valleys the acccumulation varies between 50 and 120 inches a year because of the shielding effect of the higher mountains and the manner in which the moist air is funneled against some slopes.

Although the average length of the growing season in the lower valleys is about 3 months, subfreezing temperatures have occurred during every month of the year. With increasing elevation up the mountainsides from the valley bottoms, the length of the growing season gradually decreases from about 3 months to less than 40 days at higher elevations. Probabilities of freezing temperatures in spring and fall are given in table 17.

As is the case in most mountainous areas, the wind flow pattern is very erratic. Under the stress of weak pressure gradients, the dominant wind flow is up and down the canyons as the slopes are heated by strong daytime insulation and later cooled by radiative losses through the clear dry air. Occasional strong winds develop when pressure gradients support the normal canyon drainage. Evaporation rates also vary with topography.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2
Low	2 to 3.75
Moderate low	3.75 to 5
Moderate	5 to 7.5
Moderately high	7.5 to 10
High	More than 10

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobble. A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Depth, soil. Depth to bedrock, an indurated pan, or any other layer that inhibits root growth. The depth classes used in this survey are—

	Inches
Very deep	More than 60
Deep	40 to 60
Moderately deep	20 to 40
Shallow	10 to 20
Very shallow	Less than 10

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Light textured soil. Sand and loamy sand.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in a landscape where limestone has been locally dissolved.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy*

(laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Illustrations

Figure 1.—Profile of Agassiz gravelly loam, in an area of Agassiz-Rock outcrop complex, shallow, 40 to 70 percent slopes.

Figure 2.—Landscape of Condie gravelly loam, 30 to 60 percent slopes. Skid rows up and down slope are a result of timber harvest. Vegetation is mainly Douglas-fir and alpine fir.

Figure 3.—Profile of Crooked Creek silty clay loam.

Figure 4.—Landscape of Croyden loam, 30 to 60 percent slopes. Vegetation is mainly aspen, snowberry, serviceberry, mountain brome, blue wildrye, and oniongrass.

Figure 5.—Profile of Durfee stony loam, 30 to 70 percent slopes.

Figure 6.—Landscape of Herd-Yence complex, 3 to 15 percent slopes. The extremely stony areas are mainly Yence soil, and the other areas are Herd soil. Vegetation is mainly mulesear dock, slender wheatgrass, mountain brome, and bearded wheatgrass. The Herd soil is in High mountain clay range site and the Yence soil is in High mountain stony clay range site.

Figure 7.—Landscape of Kilfoil-Rock outcrop complex, 40 to 60 percent slopes, in background.

Figure 8.—Landscape of Mondey clay loam, 8 to 15 percent slopes, seeded to intermediate wheatgrass.

Figure 9.—Landscape of Nordic gravelly loam, 30 to 60 percent slopes. Vegetation is mainly maple, Gambel oak, scattered alpine fir, mountain brome, blue wildrye, and serviceberry. Mountain loam (shrubs) range site.

Figure 10.—Profile of Smarts loam, 40 to 60 percent slopes, which has a thick, dark surface layer.

Tables

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Morgan County	Weber County	Total-- Area	Extent
		Acres	Acres	Acres	Pct
AaG	Agassiz-Rock outcrop complex, 40 to 70 percent slopes	3,665	8,365	12,030	2.0
AbG	Agassiz-Rock outcrop complex, shallow, 40 to 70 percent slopes	2,290	30	2,320	0.4
AGG	Agassiz-Geertsen-Rock outcrop association, very steep	0	1,555	1,555	0.3
AnD	Ant Flat loam, 6 to 15 percent slopes	395	1,400	1,795	0.3
BAF	Bertag silt loam, 10 to 30 percent slopes	0	600	600	0.1
BbG	Bertag silt loam, 30 to 50 percent slopes	1,365	375	1,740	0.3
BcE	Bertag cobbly loam, 20 to 40 percent slopes	1,480	0	1,480	0.2
BdG	Broad Canyon stony loam, 30 to 70 percent slopes	1,635	1,345	2,980	0.5
BeB	Broadhead clay loam, 2 to 5 percent slopes	310	0	310	0.1
BfA	Brownlee loam, 0 to 3 percent slopes	0	1,740	1,740	0.3
BfB	Brownlee loam, 3 to 6 percent slopes	0	215	215	(1)
BnC2	Bullnel gravelly loam, 2 to 15 percent slopes, eroded	3,985	0	3,985	0.7
BnG	Bullnel gravelly loam, 30 to 50 percent slopes	5,595	0	5,595	0.9
BuG	Burgi loam, 40 to 70 percent slopes	2,200	820	3,020	0.5
CaG	Caballo gravelly loam, 40 to 70 percent slopes	1,800	225	2,025	0.3
Cb	Canburn silt loam	650	340	990	0.2
CdG	Causey silt loam, 30 to 60 percent slopes	345	0	345	0.1
CeG	Causey-Choptie silt loams, 30 to 60 percent slopes	940	305	1,245	0.2
ChG	Charcol gravelly fine sandy loam, 30 to 50 percent slopes	15,200	6,195	21,395	3.5
CnG	Cloud Rim loam, 30 to 60 percent slopes	1,510	115	1,625	0.3
CoG	Condie gravelly loam, 30 to 60 percent slopes	5,010	1,230	6,240	1.0
CrG	Cristo-Wallsburg complex, 40 to 60 percent slopes	2,755	435	3,190	0.5
Ct	Crooked Creek silty clay loam	20	1,375	1,395	0.2
CvG	Croydon loam, 30 to 60 percent slopes	5,305	0	5,305	0.9
CW	Cumulic Haploborolls, wet	1,090	490	1,580	0.3
CX	Cumulic Haploxerolls, loamy	735	0	735	0.1
DaG	Donner cobbly loam, 30 to 50 percent slopes	2,685	0	2,685	0.4
DbE	Donner-Bertag cobbly loams, 10 to 40 percent slopes	4,470	0	4,470	0.7
DeG	Durfee stony loam, 30 to 70 percent slopes	9,685	6,195	15,880	2.6
DmG	Durfee-Moweba complex, 30 to 70 percent slopes	75	1,570	1,645	0.3
DuG	Durst gravelly loam, 40 to 70 percent slopes	4,560	0	4,560	0.8
EaA	Eastcan loam, 0 to 3 percent slopes	1,135	720	1,855	0.3
EcA	Eastcan loam, cool, 0 to 3 percent slopes	615	0	615	0.1
EdC	Eastcan variant loam, 6 to 10 percent slopes	660	0	660	0.1
EeC	Eastcan variant loam, cool, 6 to 10 percent slopes	285	0	285	(1)
ErD	Ercan loam, 3 to 15 percent slopes	1,135	1,160	2,295	0.4
ErE	Ercan loam, 15 to 30 percent slopes	2,610	1,110	3,720	0.6
ErG	Ercan loam, 30 to 60 percent slopes	2,310	0	2,310	0.4
EtG	Etchen very cobbly loam, 25 to 50 percent slopes	11,370	0	11,370	1.9
EVG	Etchen-Henhoit association, very steep	4,120	0	4,120	0.7
EXG	Etchen-Schuster association, very steep	2,945	0	2,945	0.5
FAB	Fluvaquentic Haploborolls-Fluventic Haploxerolls complex, 1 to 6 percent slopes	1,365	1,500	2,865	0.5
FcG	Flygare loam, 30 to 60 percent slopes	2,695	0	2,695	0.4
FdG	Foxol-Durfee complex, 30 to 70 percent slopes	0	3,360	3,360	0.6
FrG	Foxol-Rock outcrop complex, 40 to 70 percent slopes	895	10,820	11,715	1.9
GaG	Geertsen loam, 30 to 70 percent slopes	2,465	180	2,645	0.4
GcG	Geertsen-Agassiz complex, 30 to 70 percent slopes	15	4,990	5,005	0.8
GeE	Guilder loam, 15 to 30 percent slopes	2,790	0	2,790	0.5
HaC	Hades loam, 6 to 15 percent slopes	1,190	30	1,220	0.2
HaG	Hades loam, 40 to 60 percent slopes	6,450	0	6,450	1.1
HbC	Hawkins silty clay, 3 to 6 percent slopes	305	0	305	0.1
HbD	Hawkins silty clay, 6 to 15 percent slopes	1,550	565	2,115	0.3
HbE	Hawkins silty clay, 15 to 30 percent slopes	10,425	1,050	11,475	1.9
HcE	Hawkins-Collinston complex, 6 to 30 percent slopes	0	410	410	0.1
HeD	Henefer loam, 6 to 15 percent slopes	1,140	265	1,405	0.2
HeG	Henefer loam, 40 to 60 percent slopes	4,095	0	4,095	0.7
HpG	Henhoit gravelly loam, 30 to 60 percent slopes	5,160	0	5,160	0.9
HrC	Herd cobbly clay loam, 3 to 15 percent slopes	1,245	1,550	2,795	0.5
HtC	Herd-Yence complex, 3 to 15 percent slopes	3,980	8,675	12,655	2.1
HuC	Holmes very stony loam, high rainfall, 3 to 10 percent slopes	0	860	860	0.1
HvG	Horrocks-Rock outcrop complex, 40 to 70 percent slopes	2,475	160	2,635	0.4
HwG	Hoskin cobbly loam, 30 to 50 percent slopes	365	2,790	3,155	0.5
HxG	Hoskin-Rock outcrop complex, 50 to 70 percent slopes	5,830	2,265	8,095	1.3
IbG	Isbell loam, 40 to 60 percent slopes	7,110	0	7,110	1.2
IgD	Isbell loam, gravelly substratum, 6 to 15 percent slopes	750	340	1,090	0.2
KaB	Kahler gravelly loam, 3 to 6 percent slopes	0	330	330	0.1

See footnotes at end of table.

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Morgan County	Weber County	Total-- Area	Extent
		Acres	Acres	Acres	Pct
KaC	Kahler gravelly loam, 6 to 10 percent slopes	0	770	770	0.1
KfF	Kilfoil loam, 25 to 40 percent slopes	630	0	630	0.1
KrG	Kilfoil-Rock outcrop complex, 40 to 60 percent slopes	7,800	0	7,800	1.3
LaD	Lamondi stony loam, 3 to 15 percent slopes	0	2,100	2,100	0.3
LaE	Lamondi stony loam, 15 to 30 percent slopes	1,160	0	1,160	0.2
LHG	Lithic Haploxerolls-Rock outcrop complex, 40 to 80 percent slopes	5,000	80	5,080	0.8
LkD	Lucky Star silt loam, 15 to 30 percent slopes	1,225	2,950	4,175	0.7
LkG	Lucky Star silt loam, 30 to 60 percent slopes	35,750	22,410	58,160	9.6
LmG	Lucky Star-Charcol complex, 30 to 60 percent slopes	15,885	14,445	30,330	5.0
LNG	Lucky Star-Ercan association, very steep	0	3,640	3,640	0.6
MbA	Manila loam, 0 to 3 percent slopes	205	335	540	0.1
MbB	Manila loam, 3 to 6 percent slopes	510	250	760	0.1
MbC	Manila loam, 6 to 10 percent slopes	1,420	875	2,295	0.4
MbD	Manila loam, 10 to 25 percent slopes	2,540	970	3,510	0.6
MbE	Manila loam, 25 to 40 percent slopes	6,465	310	6,775	1.1
McD	Manila-Yeates Hollow complex, 10 to 25 percent slopes	1,875	0	1,875	0.3
McG	Manila-Yeates Hollow complex, 25 to 70 percent slopes	1,520	0	1,520	0.3
MeD	Mondey clay loam, 8 to 15 percent slopes	850	0	850	0.1
MeE	Mondey clay loam, 15 to 30 percent slopes	2,485	0	2,485	0.4
MoG	Morgala loam, 30 to 60 percent slopes	2,265	0	2,265	0.4
MrG	Morgala-Rock outcrop complex, 30 to 60 percent slopes	390	0	390	0.1
MwC	Moweba gravelly loam, 6 to 15 percent slopes	2,480	520	3,000	0.5
MwG	Moweba gravelly loam, 30 to 50 percent slopes	6,255	3,630	9,885	1.6
MyG	Moweba-St. Marys complex, 30 to 50 percent slopes	9,470	10,455	19,925	3.3
NAE	Nagitsy gravelly loam, 10 to 30 percent slopes	0	760	760	0.1
NcG	Nagitsy-Rock outcrop complex, 50 to 70 percent slopes	5,710	0	5,710	0.9
NDG	Nagitsy-Broad Canyon-Rock outcrop association, very steep	0	5,090	5,090	0.8
NPG	Nagitsy-Patio-Rock outcrop association, very steep	0	4,555	4,555	0.8
NrA	Nebeker clay loam, 0 to 3 percent slopes	1,175	215	1,390	0.2
NrB	Nebeker clay loam, 3 to 6 percent slopes	510	155	665	0.1
NsA	Nicodemus gravelly loam, 0 to 3 percent slopes	0	1,030	1,030	0.2
NtG	Norcan loam, 30 to 60 percent slopes	6,175	0	6,175	1.0
NuG	Nordic gravelly loam, 30 to 60 percent slopes	150	2,590	2,740	0.5
NVG	Nordic-Patio association, very steep	0	2,375	2,375	0.4
OaG	Ostler loam, 20 to 50 percent slopes	4,505	1,960	6,465	1.1
OcG	Ostler-Causey complex, 20 to 60 percent slopes	2,850	835	3,685	0.6
ODG	Ostler-Bertag association, very steep	0	2,100	2,100	0.3
PaA	Parleys loam, high rainfall, 0 to 3 percent slopes	1,300	440	1,740	0.3
PcA	Parlo loam, 0 to 3 percent slopes	245	0	245	(1)
PdG	Patio gravelly loam, 40 to 60 percent slopes	80	2,175	2,255	0.4
PhA	Phoebe fine sandy loam, 0 to 3 percent slopes	50	919	969	0.2
PoG	Poleline stony loam, 40 to 70 percent slopes	10,170	4,245	14,415	2.4
PPG	Poleline-Patio association, very steep	0	6,755	6,755	1.1
PrA	Pringle loam	2,360	0	2,360	0.4
RaG	Redcan-Etchen complex, 25 to 60 percent slopes	1,355	0	1,355	0.2
RcG	Redcan-Rock outcrop complex, 40 to 60 percent slopes	2,000	0	2,000	0.3
ReA	Redola loam, 0 to 2 percent slopes	790	0	790	0.1
RhC	Richens loam, 3 to 15 percent slopes	4,740	1,910	6,650	1.1
RvG	Richville gravelly loam, 30 to 60 percent slopes	2,860	0	2,860	0.5
RX	Rock outcrop	740	400	1,140	0.2
SaD	Scave loam, 15 to 30 percent slopes	1,610	0	1,610	0.3
SaG	Scave loam, 30 to 60 percent slopes	2,340	0	2,340	0.4
ScG	Schuster loam, 30 to 60 percent slopes	6,560	0	6,560	1.1
SeD	Sessions cobbly loam, 15 to 25 percent slopes	910	0	910	0.2
SfG	Smarts loam, 40 to 60 percent slopes	1,070	6,120	7,190	1.2
SgG	Smarts loam, moderately deep, 40 to 70 percent slopes	3,330	0	3,330	0.5
SmA	Steed loam, 0 to 1 percent slopes	290	0	290	(1)
SnA	Steed cobbly loam, 0 to 3 percent slopes	360	20	380	0.1
SoG	St. Marys cobbly loam, 30 to 50 percent slopes	20,015	10,280	30,295	5.0
SrG	St. Marys very stony loam, 40 to 60 percent slopes	2,745	0	2,745	0.5
SsD	St. Marys-Guilder complex, 3 to 25 percent slopes	1,950	0	1,950	0.3
StG	St. Marys-Hoskin cobbly loams, 30 to 50 percent slopes	5,800	0	5,800	1.0
SuD	Stoda loam, 10 to 25 percent slopes	500	0	500	0.1
SuG	Stoda loam, 40 to 60 percent slopes	1,985	0	1,985	0.3
SwA	Sunset loam, very gravelly substratum	990	525	1,515	0.2
TaG	Toncana loam, 40 to 60 percent slopes	5,405	0	5,405	0.9
TeG	Toone loam, 40 to 60 percent slopes	2,015	0	2,015	0.3
TnA	Trojan loam, warm, 0 to 3 percent slopes	0	657	657	0.1

See footnotes at end of table.

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Morgan County	Weber County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
TnD	Trojan loam, warm, 8 to 15 percent slopes	0	445	445	0.1
UaA	Utaba cobbly loam	295	0	295	(1)
UbA	Utaba cobbly loam, warm	310	1,530	1,840	0.3
UcA	Utaba loam, warm	405	0	405	0.1
YaA	Yeates Hollow loam, 2 to 5 percent slopes	265	0	265	(1)
YbC	Yeates Hollow cobbly loam, 6 to 10 percent slopes	705	0	705	0.1
YcD	Yeates Hollow very stony loam, 10 to 30 percent slopes	1,745	7,565	9,310	1.5
YdG	Yeates Hollow-Smarts complex, 30 to 70 percent slopes	0	4,640	4,640	0.8
YeD	Yeljack loam, 6 to 15 percent slopes	1,550	350	1,900	0.3
YeE	Yeljack loam, 15 to 30 percent slopes	3,265	0	3,265	0.5
	Water	805	2,992	3,797	0.6
	Total	390,400	215,423	605,823	100.0

[1]Less than 0.1 percent.

TABLE 2.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass) Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	---	---	---	---	---
II (N)	3,374	1,634	---	---	1,740
(I)	11,124	880	1,515	---	8,729
III (N)	3,945	3,700	---	245	---
(I)	9,882	5,420	2,360	290	1,812
IV (N)	8,562	8,562	---	---	---
(I)	10,822	4,892	2,385	3,545	---
V (N)	990	---	990	---	---
VI (N)	87,901	79,464	3,747	4,690	---
VII (N)	433,261	354,642	---	78,619	---
VIII(N)	---	---	---	---	---

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields were estimated for a high level of management in 1974. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Alfalfa hay		Barley		Corn silage		Oats		Pasture		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
	Ton	Ton	Bu	Bu	Ton	Ton	Bu	Bu	AUM[1]	AUM[1]	Bu	Bu
Broadhead:												
BeB	---	---	---	75	---	---	---	---	---	3.0	---	---
Brownlee:												
BfA	---	5.0	---	85	---	20	---	70	---	3.0	---	---
BfB	---	5.0	---	75	---	20	---	---	---	3.0	---	---
Canburn:												
Cb	---	---	---	---	---	---	---	---	---	2.5	---	---
Crooked Creek:												
Ct	---	---	---	70	---	---	---	---	---	3.0	---	---
Eastcan:												
EaA	---	6.0	---	90	---	22	---	---	---	3.0	---	---
EcA	---	5.0	---	60	---	---	---	---	---	3.0	---	---
Eastcan variant:												
EdC, EeC	---	4.5	---	70	---	---	---	---	---	3.0	---	---
Hawkins:												
HbC	3.5	5.0	40	70	---	---	---	---	---	---	---	---
Henefer:												
HeD	---	---	---	55	---	---	---	---	---	---	---	---
Kahler:												
KaB, KaC	2	---	---	---	---	---	---	---	---	---	45	---
Manila:												
MbA	---	5.0	---	60	---	22	---	---	---	---	---	---
MbB	---	5.0	---	60	---	---	---	---	---	5.0	---	---
MbC	3.0	4.0	40	60	---	---	---	---	---	---	---	---
MbD	3.0	4.0	40	55	---	---	---	---	---	5.0	---	---
Mondey:												
MeD	3.0	4.5	40	60	---	---	---	---	2.0	3.0	---	---
MeE	3.0	---	40	---	---	---	---	---	2.0	---	---	---
Nebeker:												
NrA	---	5.0	---	75	---	25	---	---	---	5.0	---	---
NrB	2.0	5.0	40	75	---	25	---	---	---	5.0	---	---
Nicodemus:												
NsA	---	4.0	---	50	---	---	---	50	---	2.5	---	---
Parleys:												
PaA	3.0	6.0	---	---	---	25	---	---	---	---	---	---
Parlo:												
PcA	1.5	5.0	---	75	---	22	---	---	---	---	---	---
Phoebe:												
PhA	2.5	6.0	45	90	---	20	---	---	---	12	---	---
Pringle:												
PrA	---	3.0	---	---	---	---	---	65	---	3.0	---	---

See footnotes at end of table.

TABLE 3.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Alfalfa hay		Barley		Corn silage		Oats		Pasture		Wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
	Ton	Ton	Bu	Bu	Ton	Ton	Bu	Bu	AUM[1]	AUM[1]	Bu	Bu
Redola:												
ReA	---	6.0	---	100	---	22	---	---	---	---	---	---
Steed:												
SmA	---	5.0	---	70	---	20	---	---	---	2.5	---	---
SnA	---	5.0	---	60	---	---	---	---	---	2.5	---	---
Stoda:												
SuD	3.0	---	40	---	---	---	---	---	2.0	---	---	---
Sunset:												
SwA	---	4.0	---	80	---	20	---	---	---	3.0	---	---
Trojan:												
TnA	---	---	---	60	---	---	---	---	---	2.5	---	---
TnD	---	---	---	50	---	---	---	---	---	2.5	---	---
Utaba:												
UaA, UbA	---	3.5	---	55	---	---	---	---	---	2.0	---	---
Yeates Hollow:												
YaA	---	4.0	---	70	---	---	---	---	---	5.0	---	---

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.
[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Agassiz:					
[1]AaG:					
Agassiz part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Nevada bluegrass	5
				Big sagebrush	5
Rock outcrop part.					
[1]AbG:					
Agassiz part	Mountain shallow loam, (curlleaf mountainmahogany).	Favorable	2,500	Curlleaf mountainmahogany	40
		Normal	1,800	Bluebunch wheatgrass	25
		Unfavorable	1,300	Antelope bitterbrush	5
Rock outcrop part.					
Ant Flat:					
AnD	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Bertag:					
BbG	Mountain loam (shrub)	Favorable	3,200	Bluebunch wheatgrass	30
		Normal	2,400	Bearded wheatgrass	12
		Unfavorable	1,600	Basin wildrye	10
				Gambel oak	6
				Slender wheatgrass	5
				Muttongrass	5
				Bigtooth maple	5
				Mountain snowberry	5
BcE	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
Bullnel:					
BnC2	Mountain gravelly loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,500	Nevada bluegrass	12
		Unfavorable	700	Muttongrass	10
				Oniongrass	10
				Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
BnG	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	---	Birchleaf mountainmahogany	17
		Unfavorable	1,200	Muttongrass	15
				Nevada bluegrass	12
Burgi:					
BuG	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,750	Bearded wheatgrass	8
		Unfavorable	1,500	Bluebunch wheatgrass	5
				Mountain brome	5
				Nevada bluegrass	5
				Slender wheatgrass	5
				Birchleaf mountainmahogany	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Causey:					
CdG	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
[1]CeG:					
Causey part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Choptie part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
Charcol:					
ChG	High mountain loam	Favorable	3,000	Slender wheatgrass	15
		Normal	2,500	Gambel oak	8
		Unfavorable	1,450	Basin wildrye	7
				Mountain brome	6
Cloud Rim:					
CnG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Cristo:					
[1]CrG:					
Cristo part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
Wallsburg part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5
Crooked Creek:					
Ct	Wet meadows	Favorable	6,500	Tufted hairgrass	25
		Normal	5,000	Sedge	15
		Unfavorable	3,500	Nebraska sedge	10
				Baltic rush	10
				Redtop	5
				Rush	5
				Western wheatgrass	5
Cumulic Haploborolls:					
CW	Semi-wet streambottom	Favorable	2,500	Narrowleaf cottonwood	13
		Normal	2,000	Blue wildrye	8
		Unfavorable	1,500	Willow	8
				Bearded wheatgrass	5
				Mountain brome	5
				Muttongrass	5
				Slender wheatgrass	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Cumulic Haploxerolls: CX	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Donner: DaG	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
[1]DbE: Donner part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Bertag part	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
Durfee: DeG	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
[1]DmG: Durfee part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
Moweba part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,500	Basin wildrye	8
		Unfavorable	1,200	Muttongrass	8
				Bearded wheatgrass	5
Durst: DuG	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
Etchen: EtG	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
[1]EVG: Etchen part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Etchen:					
[1]EVG:					
Henhoit part	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,750	Bearded wheatgrass	8
		Unfavorable	1,500	Bluebunch wheatgrass	5
				Mountain brome	5
				Nevada bluegrass	5
				Slender wheatgrass	5
				Birchleaf mountainmahogany	5
[1]EXG:					
Etchen part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
Schuster part	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Fluvaquentic Haploborolls:					
[1]FAB:					
Fluvaquentic Haploborolls part	Semi-wet streambottoms	Favorable	2,500	Narrowleaf cottonwood	13
		Normal	2,000	Blue wildrye	8
		Unfavorable	1,500	Willow	8
				Bearded wheatgrass	5
				Mountain brome	5
				Muttongrass	5
				Slender wheatgrass	5
Fluventic Haploxerolls part	Mountain loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Nevada bluegrass	12
		Unfavorable	1,200	Muttongrass	10
				Longtongue muttongrass	5
Foxol:					
[1]FdG:					
Foxol part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5
Durfee part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
[1]FrG:					
Foxol part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5
Rock outcrop part.					

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Geertsen:					
[1]GcG:					
Geertsen part.					
Agassiz part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Nevada bluegrass	5
				Big sagebrush	5
Guilder:					
GeE	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Hades:					
HaC, HaG	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Hawkins:					
HbD, HbE	Mountain clay	Favorable	2,350	Slender wheatgrass	40
		Normal	1,600	Bluebunch wheatgrass	8
		Unfavorable	750	Idaho fescue	5
				Letterman needlegrass	5
				Prairie junegrass	5
Henefer:					
HeD, HeG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Henhoit:					
HpG	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,750	Bearded wheatgrass	8
		Unfavorable	1,500	Bluebunch wheatgrass	5
				Mountain brome	5
				Nevada bluegrass	5
				Slender wheatgrass	5
				Birchleaf mountainmahogany	5
Herd:					
HrC	High mountain clay	Favorable	2,350	Slender wheatgrass	35
		Normal	1,775	Mountain brome	10
		Unfavorable	1,200	Mountain snowberry	8
[1]HtC:					
Herd part	High mountain clay	Favorable	2,350	Slender wheatgrass	35
		Normal	1,775	Mountain brome	10
		Unfavorable	1,200	Mountain snowberry	8
Yence part	High mountain stony clay	Favorable	1,800	Slender wheatgrass	30
		Normal	1,350	Mountain snowberry	10
		Unfavorable	900	Mountain brome	8
Holmes:					
HuC	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Horrocks:					
[1]HvG:					
Horrocks part	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	---	Bluebunch wheatgrass	8
		Unfavorable	1,500	Bearded wheatgrass	8
				Mountain brome	5
				Nevada bluegrass	5
				Birchleaf mountainmahogany	5
Rock outcrop part.					
Hoskin:					
HwG	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
[1]HxG:					
Hoskin part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
Rock outcrop part.					
Isbell:					
IbG, IgD	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Kilfoil:					
KfF	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
[1]KrG:					
Kilfoil part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
Rock outcrop part.					
Lamondi:					
LaD, LaE	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,750	Bearded wheatgrass	8
		Unfavorable	1,500	Bluebunch wheatgrass	5
				Mountain brome	5
				Nevada bluegrass	5
				Slender wheatgrass	5
				Birchleaf mountainmahogany	5
Lithic Haploxerolls:					
[1]LHG:					
Lithic Haploxerolls part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Lithic Haploxerolls: [1]LHG: Rock outcrop part.					
Manila: MbD, MbE	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
[1]McD, [1]McG: Manila part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Yeates Hollow part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12
Mondey: MeE	Mountain clay	Favorable	---	Slender wheatgrass	40
		Normal	---	Bluebunch wheatgrass	8
		Unfavorable	---	Idaho fescue	5
				Letterman needlegrass	5
				Prairie junegrass	5
Morgala: MoG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
[1]MrG: Morgala part	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Rock outcrop part.					
Moweba: MwC, MwG	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,500	Basin wildrye	8
		Unfavorable	1,200	Muttongrass	8
				Bearded wheatgrass	5
[1]MyG: Moweba part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,500	Basin wildrye	8
		Unfavorable	1,200	Muttongrass	8
				Bearded wheatgrass	5
St. Marys part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Compo-sition
			Lb/acre		Pct
Nagitsy:					
[1]NcG:					
Nagitsy part	Subalpine slopes	Favorable	2,000	Slender wheatgrass	7
		Normal	1,700	Bearded wheatgrass	5
		Unfavorable	1,450	Blue wildrye	5
				Tufted hairgrass	5
				Aster	5
				Bluebell	5
				Geranium	5
				Louisiana sagewort	5
Rock outcrop part.					
Nicodemus:					
NsA	Semi-wet stream bottoms	Favorable	2,500	Narrowleaf cottonwood	13
		Normal	2,000	Blue wildrye	8
		Unfavorable	1,500	Willow	6
				Bearded wheatgrass	5
				Mountain brome	5
				Muttongrass	5
				Slender wheatgrass	5
Norcan:					
NtG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Nordic:					
NuG	High mountain loam (shrubs)	Favorable	2,000	Bigtooth maple	12
		Normal	1,750	Blue wildrye	10
		Unfavorable	1,200	Gambel oak	8
				Mallow ninebark	7
				Chokecherry	5
Ostler:					
OaG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
[1]OcG:					
Ostler part	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Causey part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Patio:					
PdG	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Poleline:					
PoG	High mountain loam (shrub)	Favorable	2,000	Bigtooth maple	12
		Normal	1,750	Blue wildrye	10
		Unfavorable	1,200	Gambel oak	8
				Mallow ninebark	7
				Chokecherry	5
Redcan:					
[1]RaG:					
Redcan part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5
Etchen part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
[1]RcG:					
Redcan part	Mountain shallow loam	Favorable	1,700	Bluebunch wheatgrass	25
		Normal	1,100	Antelope bitterbrush	15
		Unfavorable	600	Muttongrass	10
				Basin wildrye	5
				Nevada bluegrass	5
				Big sagebrush	5
Rock outcrop part.					
Richville:					
RvG	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,500	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
Schuster:					
ScG	Mountain loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Bearded wheatgrass	6
				Bigtooth maple	5
				Mountain snowberry	5
				Serviceberry	5
				Utah snowberry	5
Sessions:					
SeD	High mountain loam (shrub)	Favorable	2,000	Bigtooth maple	12
		Normal	1,750	Blue wildrye	10
		Unfavorable	1,200	Gambel oak	8
				Mallow ninebark	7
				Chokecherry	5
Smarts:					
SfG	Mountain loam (shrub)	Favorable	3,200	Bluebunch wheatgrass	30
		Normal	2,400	Bearded wheatgrass	12
		Unfavorable	1,600	Basin wildrye	10
				Gambel oak	6
				Muttongrass	5
				Slender wheatgrass	5
				Bigtooth maple	5
				Mountain snowberry	5

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Smarts:					
SgG	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,650	Bluebunch wheatgrass	10
		Unfavorable	1,450	Mountain snowberry	10
				Bearded wheatgrass	6
				Bigtooth maple	5
				Serviceberry	5
St. Marys:					
SoG, SrG	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12
[1]SsD:					
St. Marys part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12
Guilder part	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
[1]StG:					
St. Marys part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12
Hoskin part	Mountain stony loam	Favorable	2,500	Bluebunch wheatgrass	30
		Normal	1,700	Oniongrass	10
		Unfavorable	700	Antelope bitterbrush	10
				Big sagebrush	7
				Idaho fescue	5
				Prairie junegrass	5
Stoda:					
SuG	Mountain loam	Favorable	2,600	Bluebunch wheatgrass	40
		Normal	1,850	Basin wildrye	8
		Unfavorable	1,200	Bearded wheatgrass	5
				Muttongrass	5
Toncana:					
TaG	Mountain gravelly loam (oak)	Favorable	2,300	Gambel oak	25
		Normal	1,750	Bearded wheatgrass	8
		Unfavorable	1,500	Bluebunch wheatgrass	5
				Mountain brome	5
				Nevada bluegrass	5
				Slender wheatgrass	5
				Birchleaf mountainmahogany	5
Toone:					
TeG	High mountain loam (shrub)	Favorable	2,000	Bigtooth maple	12
		Normal	1,750	Blue wildrye	10
		Unfavorable	1,200	Gambel oak	8
				Mallow ninebark	7
				Chokecherry	5
Yeates Hollow:					
YbC	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Birchleaf mountainmahogany	15
		Unfavorable	1,200	Nevada bluegrass	12
				Muttongrass	10
				Longtongue muttongrass	5
YcD	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12

See footnotes at end of table.

TABLE 4.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Yeates Hollow:					
[1]YdG:					
Yeates Hollow part	Mountain gravelly loam	Favorable	2,400	Bluebunch wheatgrass	30
		Normal	1,700	Muttongrass	15
		Unfavorable	1,200	Birchleaf mountainmahogany	15
				Nevada bluegrass	12
Smarts part	Mountain loam (shrub)	Favorable	3,200	Bluebunch wheatgrass	30
		Normal	2,400	Bearded wheatgrass	12
		Unfavorable	1,600	Basin wildrye	10
				Gambel oak	6
				Muttongrass	5
				Slender wheatgrass	5
				Bigtooth maple	5
				Mountain snowberry	5
Yeljack:					
YeD, YeE	High mountain loam	Favorable	3,000	Slender wheatgrass	15
		Normal	2,500	Gambel oak	8
		Unfavorable	1,450	Basin wildrye	7
				Mountain brome	6

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Broad Canyon:									
BdG	6f	Moderate	Severe	Moderate	Slight	Moderate	Douglas-fir	36	Douglas-fir.
Caballo:									
CaG	3f	Severe	Moderate	Slight	Slight	Moderate	Douglas-fir White fir	65 60	Douglas-fir.
Condie:									
CoG	6f	Moderate	Moderate	Moderate	Slight	Moderate	Douglas-fir White fir	44 45	Douglas-fir.
Croydon:									
CvG	4r	Slight	Moderate	Slight	Slight	Moderate	Quaking aspen	51	
Ercan:									
ErD, ErE	3o	Slight	Slight	Slight	Slight	Slight	Quaking aspen	64	
ErG	3r	Moderate	Moderate	Slight	Slight	Slight	Quaking aspen	64	
Flygare:									
FcG	3f	Moderate	Moderate	Slight	Slight	Slight	Quaking aspen	64	Engelmann spruce, Douglas-fir, blue spruce.
Geertsen:									
GaG	6f	Moderate	Moderate	Moderate	Slight	Moderate	Douglas-fir	44	Douglas-fir.
[1]GcG:									
Geertsen part	6f	Moderate	Moderate	Moderate	Slight	Moderate	Douglas-fir	44	Douglas-fir.
Agassiz part.									
Lucky Star:									
LkD	2f	Slight	Slight	Slight	Slight	Moderate	Quaking aspen	77	
LkG	2f	Moderate	Moderate	Slight	Slight	Moderate	Quaking aspen	77	
[1]LmG:									
Lucky Star part	2f	Moderate	Moderate	Slight	Slight	Moderate	Quaking aspen	77	
Charcol part.									
Richens:									
RhC	3o	Slight	Slight	Slight	Slight	Moderate	Quaking aspen	64	
Scave:									
SaD	2f	Slight	Slight	Slight	Slight	Moderate	Quaking aspen	74	
SaG	2f	Slight	Moderate	Slight	Slight	Moderate	Quaking aspen	74	

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 6.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Agassiz:											
[1]AaG:											
Agassiz part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Rock outcrop part.											
[1]AbG:											
Agassiz part	Very poor.	Very poor.	Poor	Poor	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Fair.
Rock outcrop part.											
[1]AGG:											
Agassiz part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Geertsen part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Rock outcrop part.											
Ant Flat:											
AnD	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Bertag:											
BAF	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
BbG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
BcE	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
Broad Canyon:											
BdG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Broadhead:											
BeB	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Brownlee:											
BfA, BfB	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Bullnel:											
BnC2	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
BnG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Burgi:											
BuG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Caballo:											
CaG	Very poor.	Very poor.	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Canburn:											
Cb	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Causey:											
CdG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]CeG:											
Causey part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Choptie part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Charcol:											
ChG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Cloud Rim:											
CnG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Condie:											
CoG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Cristo:											
[1]CrG:											
Cristo part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Wallsburg part	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Crooked Creek:											
Ct	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
Croydon:											
CvG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
Cumulic Haploborolls:											
CW	Poor	Poor	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Cumulic Haploxerolls:											
CX	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Donner:											
DaG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]DbE:											
Donner part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Bertag part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Durfee:											
DeG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Durfee:											
[1]DmG:											
Durfee part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Moweba part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Durst:											
DuG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Eastcan:											
EaA	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
EcA	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor	Good.
Eastcan variant:											
EdC, EeC	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor	Good.
Ercan:											
ErD, ErE	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
ErG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Etchen:											
EtG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
[1]EVG:											
Etchen part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Henhoit part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]EXG:											
Etchen part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Schuster part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Fluvaquentic Haploborolls:											
[1]FAB:											
Fluvaquentic Haploborolls part	Poor	Poor	Good	Good	Good	Fair	Very poor.	Fair	Good	Poor	Good.
Fluventic Haploxerolls part	Poor	Poor	Good	Good	Good	Fair	Very poor.	Fair	Good	Poor	Good.
Flygare:											
FcG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Foxol:											
[1]FdG:											
Foxol part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Foxol:											
[1]FdG:											
Durfee part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]FrG:											
Foxol part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Rock outcrop part.											
Geertsen:											
GaG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
[1]GcG:											
Geertsen part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Agassiz part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Guilder:											
GeE	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Hades:											
HaC	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
HaG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Hawkins:											
HbC, HbD	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
HbE	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
[1]HcE:											
Hawkins part.											
Collinston part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Henefer:											
HeD	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
HeG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Henhoit:											
HpG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Herd:											
HrC	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
[1]HtC:											
Herd part	Very poor.	Very poor.	Good	Good	Good	Very	Very	Poor	Fair	Very	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Herd:											
HtC:											
Yence part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Holmes:											
HuC	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Horrocks:											
[1]HvG:											
Horrocks part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop part.											
Hoskin:											
HwG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Hoskin:											
[1]HxG:											
Hoskin part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Rock outcrop part.											
Isbell:											
IbG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
IgD	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Kahler:											
KaB, KaC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Kilfoil:											
KfF	Poor	Fair	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]KrG:											
Kilfoil part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Rock outcrop part.											
Lamondi:											
LaD, LaE	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Lithic Haploxerolls:											
[1]LHG:											
Lithic Haploxerolls part	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Rock outcrop part.											
Lucky Star:											
LkD	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Lucky Star:											
LkG----------------	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]LmG:											
Lucky Star part-	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Charcol part----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]LNG:											
Lucky Star part-	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Ercan part-------	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Manila:											
MbA, MbB, MbC, MbD	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
MbE----------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
[1]McD, [1]McG:											
Manila part------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Yeates Hollow part------------	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Mondey:											
MeD----------------	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
MeE----------------	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Morgala:											
MoG----------------	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]MrG:											
Morgala part----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Rock outcrop part.											
Moweba:											
MwC----------------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
MwG----------------	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]MyG:											
Moweba part------	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
St. Marys part--	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Nagitsy:											
NAE----------------	Poor	Fair	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Nagitsy:											
[1]NcG:											
Nagitsy part	Very poor.	Very poor.	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop part.											
[1]NDG:											
Nagitsy part	Very poor.	Very poor.	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Broad Canyon part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Rock outcrop part.											
[1]NPG:											
Nagitsy part	Very poor.	Very poor.	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Patio part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Rock outcrop part.											
Nebeker:											
NrA, NrB	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Nicodemus:											
NsA	Poor	Poor	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Norcan:											
NtG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Nordic:											
NuG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]NVG:											
Nordic part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Patio part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Ostler:											
OaG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]OcG:											
Ostler part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Causey part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]ODG:											
Ostler part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Bertag part	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Parleys:											
PaA	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Parlo: PcA	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Patio: PdG	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Phoebe: PhA	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Poleline: PoG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]PPG: Poleline part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Patio part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Pringle: PrA	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair	Good.
Redcan: [1]RaG: Redcan part	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Etchen part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
[1]RcG: Redcan part	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Rock outcrop part.											
Redola: ReA	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Richens: RhC	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Richville: RvG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop: RX.											
Scave: SaD	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
SaG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Schuster: ScG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Sessions:											
SeD	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Smarts:											
SfG, SgG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Steed:											
SmA	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
SnA	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.	Fair.
St. Marys:											
SoG, SrG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
[1]SsD:											
St. Marys part	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Guilder part	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
[1]StG:											
St. Marys part	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Hoskin part	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Stoda:											
SuD	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
SuG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Sunset:											
SwA	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Toncana:											
TaG	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Toone:											
TeG	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Trojan:											
TnA	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
TnD	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Utaba:											
UaA, UbA, UcA	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.	Fair.
Yeates Hollow:											
YaA	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
YbC	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

See footnotes at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Yeates Hollow: YoD	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
[1]YdG: Yeates Hollow part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Smarts part	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
Yeljack: YeD, YeE	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Agassiz:				
[1]AaG:				
Agassiz part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
Rock outcrop part.				
[1]AbG:				
Agassiz part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop part.				
[1]AGG:				
Agassiz part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
Geertsen part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.				
Ant Flat:				
AnD	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Bertag:				
BAF	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
BbG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BcE	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Broad Canyon:				
BdG	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.
Broadhead:				
BeB	Severe: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Brownlee:				
BfA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
BfB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Bullnel:				
BnC2	Moderate: slope, percs slowly, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Bullnel:				
BnG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Burgi:				
BuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Caballo:				
CaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canburn:				
Cb	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Causey:				
CdG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CeG:				
Causey part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Choptie part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Charcol:				
ChG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Cloud Rim:				
CnG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Condie:				
CoG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Cristo:				
[1]CrG:				
Cristo part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wallsburg part	Severe: small stones, slope.	Severe: slope, small stones.	Severe: slope, depth to rock.	Severe: slope, small stones.
Crooked Creek:				
Ct	Severe: wetness, floods, too clayey.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.
Croydon:				
CvG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cumulic Haploborolls:				
CW	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cumulic Haploxerolls:				
CX	Severe: floods.	Moderate: floods.	Severe: slope.	Slight.
Donner:				
DaG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]DbE:				
Donner part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Bertag part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Durfee:				
DeG	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.
[1]DmG:				
Durfee part	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.
Moweba part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Durst:				
DuG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Eastcan:				
EaA, EcA	Moderate: floods.	Slight	Slight	Slight.
Eastcan variant:				
EdC, EeC	Moderate: slope, percs slowly, excess humus.	Moderate: slope.	Severe: slope.	Slight.
Ercan:				
ErD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
ErE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
ErG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Etchen:				
EtG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]EVG:				
Etchen part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Etchen:				
[1]EVC:				
Henhoit part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]EXG:				
Etchen part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Schuster part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fluvaquentic Haploborolls:				
[1]FAB:				
Fluvaquentic Haploborolls part	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Slight.
Fluventic Haploxerolls part	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Flygare:				
FcG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Foxol:				
[1]FdG:				
Foxol part	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope, small stones.
Durfee part	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope.
[1]FrG:				
Foxol part	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope, small stones.
Rock outcrop part.				
Geertsen:				
GaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]GcG:				
Geertsen part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Agassiz part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
Guilder:				
GeE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Hades:				
HaC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hades:				
HaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hawkins:				
HbC	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
HbD	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.
HbE	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey.
[1]HcE:				
Hawkins part	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: slope, too clayey.	Severe: too clayey.
Collinston part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Henefer:				
HeD	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
HeG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Henhoit:				
HpG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Herd:				
HrC	Moderate: percs slowly, slope, small stones.	Moderate: small stones, too clayey, slope.	Severe: small stones, slope.	Moderate: small stones.
[1]HtC:				
Herd part	Moderate: percs slowly, slope, small stones.	Moderate: small stones, too clayey, slope.	Severe: small stones, slope.	Moderate: small stones.
Yence part	Severe: large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
Holmes:				
HuC	Severe: small stones, large stones.	Severe: small stones, large stones.	Severe: slope, small stones, large stones.	Severe: small stones, large stones.
Horrocks:				
[1]HvG:				
Horrocks part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop part.				

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hoskin:				
HwG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]HxG:				
Hoskin part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop part.				
Isbell:				
IbG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
IgD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Kahler:				
KaB	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
KaC	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
Kilfoil:				
KfF	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]KrG:				
Kilfoil part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.				
Lamondi:				
LaD	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope.	Moderate: large stones.
LaE	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: slope, large stones.
Lithic Haploxerolls:				
[1]LHG:				
Lithic Haploxerolls part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop part.				
Lucky Star:				
LkD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
LkG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]LmG:				
Lucky Star part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Charcol part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lucky Star:				
[1]LNG:				
Lucky Star part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ercan part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Manila:				
MbA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
MbB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
MbC	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
MbD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
MbE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]McD:				
Manila part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Yeates Hollow part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, small stones.	Moderate: slope, small stones, large stones.
[1]McG:				
Manila part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yeates Hollow part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, small stones.	Severe: slope.
Mondey:				
MeD	Moderate: slope, too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
MeE	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
Morgala:				
MoG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]MrG:				
Morgala part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.				
Moweba:				
MwC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
MwG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Moweba:				
[1]MyG:				
Moweba part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
St. Marys part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Nagitsy:				
NAE	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones, dusty.
[1]NcG:				
Nagitsy part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop part.				
[1]NDG:				
Nagitsy part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Broad Canyon part	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.
Rock outcrop part.				
[1]NPG:				
Nagitsy part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Patio part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.				
Nebeker:				
NrA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
NrB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Nicodemus:				
NsA	Moderate: wetness, small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Norcan:				
NtG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Nordic:				
NuG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
[1]NVG:				
Nordic part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Nordic:				
[1]NVG:				
Patio part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ostler:				
OaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]OcG:				
Ostler part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Causey part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]ODG:				
Ostler part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bertag part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Parleys:				
PaA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Parlo:				
PcA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Patio:				
PdG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Phoebe:				
PhA	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Poleline:				
PoG	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.
[1]PPG:				
Poleline part	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.
Patio part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pringle:				
PrA	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.
Redcan:				
[1]RaG:				
Redcan part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
Etchen part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Redcan:				
[1]RcG:				
Redcan part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
Rock outcrop part.				
Redola:				
ReA	Slight	Slight	Slight	Slight.
Richens:				
RhC	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Richville:				
RvG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop:				
RX.				
Scave:				
SaD	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
SaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Schuster:				
ScG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sessions:				
SeD	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Smarts:				
SfG, SgG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steed:				
SmA	Severe: floods.	Severe: floods.	Severe: floods.	Slight.
SnA	Severe: floods.	Severe: floods.	Severe: floods, small stones.	Moderate: small stones.
St. Marys:				
SoG	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
SrG	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
[1]SsD:				
St. Marys part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Guilder part	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.

See footnotes at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
St. Marys:				
[1]StG:				
St. Marys part-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Hoskin part--------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Stoda:				
SuD----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
SuG----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunset:				
SwA----------------	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Toncana:				
TaG----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Toone:				
TeG----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Trojan:				
TnA----------------	Slight-------------	Slight-------------	Slight-------------	Slight.
TnD----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Utaba:				
UaA, UbA-----------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
UcA----------------	Slight-------------	Slight-------------	Slight-------------	Slight.
Yeates Hollow:				
YaA----------------	Slight-------------	Slight-------------	Moderate: small stones, slope.	Slight.
YbC----------------	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: small stones, slope.	Moderate: small stones.
YcD----------------	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, small stones.	Moderate: slope, small stones, large stones.
[1]YdG:				
Yeates Hollow part-	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, small stones.	Severe: slope.
Smarts part--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yeljack:				
YeD----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
YeE----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Agassiz:					
[1]AaG, [1]AbG:					
Agassiz part	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Rock outcrop part.					
[1]AGG:					
Agassiz part	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Geertsen part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.					
Ant Flat:					
AnD	Moderate: too clayey, depth to rock, slope.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: shrink-swell, low strength.
Bertag:					
BAF, BbG, BcE	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope.
Broad Canyon:					
BdG	Severe: slope, large stones, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Broadhead:					
BeB	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Brownlee:					
BfA	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, frost action, shrink-swell.
BfB	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, low strength, shrink-swell.	Moderate: low strength, frost action, shrink-swell.
Bullnel:					
BnC2	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock, low strength.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Bullnel:					
BnG-----------------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Burgi:					
BuG-----------------	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Caballo:					
CaG-----------------	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canburn:					
Cb------------------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Causey:					
CdG-----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]CeG:					
Causey part--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Choptie part-------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Charcol:					
ChG-----------------	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cloud Rim:					
CnG-----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Condie:					
CoG-----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cristo:					
[1]CrG:					
Cristo part--------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Wallsburg part-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Crooked Creek:					
Ct------------------	Severe: wetness, too clayey.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, low strength, shrink-swell.
Croydon:					
CvG-----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Cumulic Haploborolls:					
CW	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.
Cumulic Haploxerolls:					
CX	Severe: floods.	Severe: floods.	Severe: floods.	Severe: slope, floods.	Severe: floods.
Donner:					
DaG	Severe: slope, too clayey.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
[1]DbE:					
Donner part	Severe: slope, too clayey.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Bertag part	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope.
Durfee:					
DeG	Severe: slope, small stones, too clayey.	Severe: slope.	Severe: slope, low strength.	Severe: slope.	Severe: slope, low strength.
[1]DmG:					
Durfee part	Severe: slope, small stones, too clayey.	Severe: slope.	Severe: slope, low strength.	Severe: slope.	Severe: slope, low strength.
Moweba part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Durst:					
DuG	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Eastcan:					
EaA, EcA	Moderate: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.
Eastcan variant:					
EdC, EeC	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
Ercan:					
ErD	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: slope, shrink-swell, frost action.
ErE, ErG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Etchen:					
EtG	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
[1]EVG:					
Etchen part	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Henhoit part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]EXG:					
Etchen part	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Schuster part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fluvaquentic Haploborolls:					
[1]FAB:					
Fluvaquentic Haploborolls part	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Fluventic Haploxerolls part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Flygare:					
FcG	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Foxol:					
[1]FdG:					
Foxol part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Durfee part	Severe: slope, small stones, too clayey.	Severe: slope.	Severe: slope, low strength.	Severe: slope.	Severe: slope, low strength.
[1]FrG:					
Foxol part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Rock outcrop part.					
Geertsen:					
GaG	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Geertsen:					
[1]GcG:					
Geertsen part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Agassiz part	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Guilder:					
GeE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Hades:					
HaC	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: slope, shrink-swell, low strength.
HaG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hawkins:					
HbC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
HbD	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.
HbE	Severe: slope, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
[1]HcE:					
Hawkins part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.
Collinston part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
Henefer:					
HeD	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
HeG	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Henholt:					
HpG	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Herd:					
HrC	Severe: too clayey.	Moderate: slope, low strength.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: low strength, shrink-swell.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Herd:					
[1]HtC:					
Herd part	Severe: too clayey.	Moderate: slope, low strength.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: low strength, shrink-swell.
Yence part	Severe: too clayey, large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: low strength.
Holmes:					
HuC	Severe: small stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action.
Horrocks:					
[1]HvG:					
Horrocks part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.					
Hoskin:					
HwG	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
[1]HxG:					
Hoskin part	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Rock outcrop part.					
Isbell:					
IbG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
IgD	Moderate: too clayey, slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell, frost action.
Kahler:					
KaB	Moderate: small stones.	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action, shrink-swell.
KaC	Moderate: small stones.	Slight	Slight	Severe: slope.	Moderate: low strength, shrink-swell.
Kilfoil:					
KfF	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
[1]KrG:					
Kilfoil part	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Kilfoil:					
[1]KrG:					
Rock outcrop part.					
Lamondi:					
LaD	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
LaE	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lithic Haploxerolls:					
[1]LHG:					
Lithic Haploxerolls part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Rock outcrop part.					
Lucky Star:					
LkD, LkG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]LmG:					
Lucky Star part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Charcol part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]LNG:					
Lucky Star part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ercan part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Manila:					
MbA, MbB	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
MbC	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.
MbD, MbE	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.
[1]McD, [1]McG:					
Manila part	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.
Yeates Hollow part	Severe: slope, too clayey, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Mondey:					
MeD----------------	Severe: too clayey.	Severe: shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
MeE----------------	Severe: too clayey, slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength, slope.
Morgala:					
MoG----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
[1]MrG:					
Morgala part------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Rock outcrop part.					
Moweba:					
MwC----------------	Severe: small stones.	Moderate: slope, low strength.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.
MwG----------------	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]MyG:					
Moweba part-------	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
St. Marys part---	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Nagitsy:					
NAE----------------	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
[1]NcG:					
Nagitsy part------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Rock outcrop part.					
[1]NDG:					
Nagitsy part------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Broad Canyon part	Severe: slope, large stones, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop part.					

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Nagitsy:					
[1]NPG:					
Nagitsy part	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Patio part	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Rock outcrop part.					
Nebeker:					
NrA, NrB	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Nicodemus:					
NsA	Severe: floods, cutbanks cave, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Moderate: frost action, floods, low strength.
Norcan:					
NtG	Severe: slope, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.
Nordic:					
NuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]NVG:					
Nordic part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Patio part	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Ostler:					
OaG	Severe: slope, too clayey.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
[1]OcG:					
Ostler part	Severe: slope, too clayey.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Causey part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]ODG:					
Ostler part	Severe: slope, too clayey.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Bertag part	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Parleys:					
PaA	Slight	Moderate: low strength, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Severe: low strength, frost action, shrink-swell.
Parlo:					
PcA	Severe: cutbanks cave.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Severe: frost action, low strength.
Patio:					
PdG	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Phoebe:					
PhA	Slight	Slight	Slight	Slight	Moderate: frost action.
Poleline:					
PoG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]PPG:					
Poleline part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Patio part	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Pringle:					
PrA	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Redcan:					
[1]RaG:					
Redcan part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Etchen part	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
[1]RcG:					
Redcan part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop part.					
Redola:					
ReA	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.
Richens:					
RhC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.	Severe: shrink-swell, low strength.
Richville:					
RvG	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Rock outcrop:					
RX.					
Scave:					
SaD, SaG	Severe: slope, too clayey, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Schuster:					
ScG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sessions:					
SeD	Severe: too clayey, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Smarts:					
SfG, SgG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steed:					
SmA, SnA	Severe: floods, cutbanks cave, small stones.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
St. Marys:					
SoG	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SrG	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]SsD:					
St. Marys part	Severe: small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Guilder part	Moderate: slope, too clayey.	Moderate: slope, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
[1]StG:					
St. Marys part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hoskin part	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Stoda:					
SuD, SuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sunset:					
SwA	Severe: floods, wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, floods, frost action.
Toncana:					
TaG	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnotes at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Toone:					
TeG	Severe: slope, small stones, too clayey.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Trojan:					
TnA	Moderate: small stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell, low strength.
TnD	Moderate: slope, small stones.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.
Utaba:					
UaA, UbA, UcA	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Yeates Hollow:					
YaA	Severe: too clayey, small stones.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength, frost action.
YbC	Severe: too clayey, small stones.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, frost action, low strength.
YcD	Severe: slope, too clayey, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
[1]YdG:					
Yeates Hollow part	Severe: slope, too clayey, small stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Smarts part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yeljack:					
YeD	Moderate: slope.	Moderate: slope, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: slope.	Moderate: frost action, slope, low strength.
YeE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.--SANITARY FACILITIES

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Agassiz:					
[1]AaG, [1]AbG:					
Agassiz part	Severe: slope, depth to rock.	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, small stones, slope.
Rock outcrop part					
[1]AGG:					
Agassiz part	Severe: slope, depth to rock.	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, small stones, slope.
Geertsen part	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Rock outcrop part					
Ant Flat:					
AnD	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Bertag:					
BAF	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
BbG, BcE	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Broad Canyon:					
BdG	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones, large stones.
Broadhead:					
BeB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Brownlee:					
BfA	Severe: percs slowly.	Slight	Slight	Slight	Good.
BfB	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Bullnel:					
BnC2	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer, small stones.
BnG	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Burgi:					
BuG	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones, area reclaim.
Caballo:					
CaG	Severe: depth to rock, slope.	Severe: slope, small stones.	Severe: depth to rock, slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
Canburn:					
Cb	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Causey:					
CdG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]CeG:					
Causey part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Choptie part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Charcol:					
ChG	Severe: slope.	Severe: slope, small stones, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
Cloud Rim:					
CnG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Condie:					
CoG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Poor: slope, small stones.
Cristo:					
[1]CrG:					
Cristo part	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Wallsburg part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
Crooked Creek:					
Ct	Severe: wetness, percs slowly, floods.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness, too clayey.
Croydon:					
CvG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Cumulic Haploborolls:					
CW	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Cumulic Haploxerolls:					
CX	Severe: floods.	Severe: slope, floods.	Severe: floods.	Severe: floods.	
Donner:					
DaG	Severe: slope, percs slowly.	Severe: slope, depth to rock.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
[1]DbE:					
Donner part	Severe: slope, percs slowly.	Severe: slope, depth to rock.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
Bertag part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Durfee:					
DeG	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, too clayey, small stones.	Severe: slope.	Poor: slope, small stones, too clayey.
[1]DmG:					
Durfee part	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, too clayey, small stones.	Severe: slope.	Poor: slope, small stones, too clayey.
Moweba part	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
Durst:					
DuG	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope.	Poor: slope, thin layer, small stones.
Eastcan:					
EaA, EcA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: floods.	Good.
Eastcan variant:					
EdC, EeC	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
Ercan:					
ErD	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, thin layer.
ErE	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
ErG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Etchen:					
EtG	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope.	Poor: slope, small stones.
[1]EVG:					
Etchen part	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope.	Poor: slope, small stones.
Henhoit part	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
[1]EXG:					
Etchen part	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope.	Poor: slope, small stones.
Schuster part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
Fluvaquentic Haploborolls:					
[1]FAB:					
Fluvaquentic Haploborolls part	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	
Fluventic Haploxerolls part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	
Flygare:					
FcG	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones.
Foxol:					
[1]FdG:					
Foxol part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer.
Durfee part	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, too clayey, small stones.	Severe: slope.	Poor: slope, small stones, too clayey.
[1]FrG:					
Foxol part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer.
Rock outcrop part					
Geertsen:					
GaG	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Geertsen:					
[1]GcG:					
Geertsen part	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Agassiz part	Severe: slope, depth to rock.	Severe: small stones, depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, small stones, slope.
Guilder:					
GeE	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
Hades:					
HaC	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
HaG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hawkins:					
HbC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
HbD	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
HbE	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey, hard to pack.
[1]HcE:					
Hawkins part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Collinston part	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Henefer:					
HeD	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
HeG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Henhoit:					
HpG	Severe: slope, percs slowly.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
Herd:					
HrC	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, hard to pack, area reclaim.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Herd:					
[1]HtC:					
Herd part	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, hard to pack, area reclaim.
Yence part	Severe: percs slowly, large stones, depth to rock.	Severe: slope, large stones.	Severe: too clayey, large stones, depth to rock.	Moderate: slope.	Poor: too clayey, large stones, area reclaim.
Holmes:					
HuC	Moderate: large stones.	Severe: seepage, large stones.	Severe: seepage.	Slight	Poor: large stones, small stones.
Horrocks:					
[1]HvG:					
Horrocks part	Severe: slope, depth to rock.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope.	Poor: slope, small stones.
Rock outcrop part					
Hoskin:					
HwG	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones, area reclaim.
[1]HxG:					
Hoskin part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones, area reclaim.
Rock outcrop part					
Isbell:					
IbG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, area reclaim.
IgD	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: slope.	Fair: slope, too clayey.
Kahler:					
KaB	Slight	Moderate: slope, seepage.	Slight	Slight	Fair: small stones.
KaC	Moderate: slope.	Severe: slope.	Slight	Slight	Fair: small stones.
Kilfoil:					
KfF	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, area reclaim.
[1]KrG:					
Kilfoil part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, area reclaim.
Rock outcrop part					

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lamondi:					
LaD	Moderate: slope.	Severe: slope, small stones.	Severe: small stones.	Moderate: slope.	Poor: small stones.
LaE	Severe: slope.	Severe: slope, small stones.	Severe: small stones.	Severe: slope.	Poor: slope, small stones.
Lithic Haploxerolls:					
[1]LHG:					
Lithic Haploxerolls part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer.
Rock outcrop part					
Lucky Star:					
LkD	Severe: slope.	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, small stones.
LkG	Severe: slope.	Severe: slope, seepage, small stones.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
[1]LmG:					
Lucky Star part	Severe: slope.	Severe: slope, seepage, small stones.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
Charcol part	Severe: slope.	Severe: slope, small stones, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
[1]LNG:					
Lucky Star part	Severe: slope.	Severe: slope, seepage, small stones.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
Ercan part	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
Manila:					
MbA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
MbB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
MbC	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
MbD	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
MbE	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Manila:					
[1]McD:					
Manila part	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
Yeates Hollow part	Severe: slope, percs slowly.	Severe: large stones, slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, small stones.
[1]McG:					
Manila part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Yeates Hollow part	Severe: slope, percs slowly.	Severe: large stones, slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, small stones.
Mondey:					
MeD	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
MeE	Severe: percs slowly, slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.	Poor: slope.
Morgala:					
MoG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
[1]MrG:					
Morgala part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Rock outcrop part					
Moweba:					
MwC	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: small stones, slope.
MwG	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
[1]MyG:					
Moweba part	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
St. Marys part	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, small stones.	Severe: slope.	Poor: slope, small stones.
Nagitsy:					
NAE	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Nagitsy:					
[1]NcG:					
Nagitsy part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Rock outcrop part					
[1]NDG:					
Nagitsy part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Broad Canyon part	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones, large stones.
Rock outcrop part					
[1]NPG:					
Nagitsy part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Patio part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Rock outcrop part					
Nebeker:					
NrA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
NrB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Nicodemus:					
NsA	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: small stones.
Norcan:					
NtG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Nordic:					
NuG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, small stones, area reclaim.
[1]NVG:					
Nordic part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, small stones, area reclaim.
Patio part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Ostler:					
OaG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, hard to pack, too clayey.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ostler:					
[1]OcG:					
Ostler part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, hard to pack, too clayey.
Causey part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]ODG:					
Ostler part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, hard to pack, too clayey.
Bertag part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
Parleys:					
PaA	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Parlo:					
PcA	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Patio:					
PdG	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Phoebe:					
PhA	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Poleline:					
PoG	Severe: slope.	Severe: slope, seepage, large stones.	Severe: slope, seepage, depth to rock.	Severe: slope.	Poor: slope, small stones, large stones.
[1]PPG:					
Poleline part	Severe: slope.	Severe: slope, seepage, large stones.	Severe: slope, seepage, depth to rock.	Severe: slope.	Poor: slope, small stones, large stones.
Patio part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones, area reclaim.
Pringle:					
PrA	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: wetness, small stones.
Redcan:					
[1]RaG:					
Redcan part	Severe: slope, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Etchen part	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Redcan:					
[1]RcG:					
Redcan part	Severe: slope, depth to rock.	Severe: slope, depth to rock, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Rock outcrop part					
Redola:					
ReA	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Richens:					
RhC	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey, hard to pack.
Richville:					
RvG	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer, area reclaim.
Rock outcrop:					
RX.					
Scave:					
SaD	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey, small stones.	Severe: slope.	Poor: slope, too clayey, small stones.
SaG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey, small stones.	Severe: slope.	Poor: slope, too clayey, small stones.
Schuster:					
ScG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
Sessions:					
SeD	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey, slope, area reclaim.
Smarts:					
SfG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
SgG	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
Steed:					
SmA, SnA	Severe: floods, small stones.	Severe: seepage, floods.	Severe: floods, seepage, small stones.	Severe: floods, seepage.	Poor: thin layer, small stones, seepage.
St. Marys:					
SoG	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, small stones.	Severe: slope.	Poor: slope, small stones.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
St. Marys:					
SrG	Severe: slope.	Severe: slope, seepage, large stones.	Severe: slope, seepage, small stones.	Severe: slope.	Poor: slope, large stones.
[1]SsD:					
St. Marys part	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, small stones.	Moderate: slope.	Poor: small stones.
Guilder part	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
[1]StG:					
St. Marys part	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, small stones.	Severe: slope.	Poor: slope, small stones.
Hoskin part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones, area reclaim.
Stoda:					
SuD	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
SuG	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sunset:					
SwA	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods.	Good.
Toncana:					
TaG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Poor: slope, small stones, area reclaim.
Toone:					
TeG	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, small stones, too clayey.
Trojan:					
TnA	Moderate: percs slowly.	Moderate: seepage, small stones.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
TnD	Moderate: slope, percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey, small stones.
Utaba:					
UaA, UbA, UcA	Severe: floods.	Severe: seepage, floods, small stones.	Severe: seepage, floods, small stones.	Severe: seepage, floods.	Poor: small stones, seepage.
Yeates Hollow:					
YaA	Severe: percs slowly.	Severe: small stones.	Severe: depth to rock.	Slight	Poor: small stones, too clayey.

See footnotes at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Yeates Hollow:					
YbC	Severe: percs slowly.	Severe: small stones, slope.	Severe: depth to rock.	Moderate: slope.	Poor: small stones, too clayey.
YcD	Severe: slope, percs slowly.	Severe: large stones, slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, small stones.
[1]YdG:					
Yeates Hollow part	Severe: slope, percs slowly.	Severe: large stones, slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey, small stones.
Smarts part	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
Yeljack:					
YeD	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
YeE	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Agassiz:				
[1]AaG, [1]AbG:				
Agassiz part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, thin layer.
Rock outcrop part.				
[1]AGG:				
Agassiz part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, thin layer.
Geertsen part	Poor: slope.	Unsuited	Unsuited	Poor: thin layer, slope, small stones.
Rock outcrop part.				
Ant Flat:				
AnD	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: slope, thin layer.
Bertag:				
BAF	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
BbG	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
BcE	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, small stones.
Broad Canyon:				
BdG	Poor: slope, area reclaim.	Poor: large stones.	Poor: large stones.	Poor: small stones, slope, area reclaim.
Broadhead:				
BeB	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer, too clayey.
Brownlee:				
BfA, BfB	Fair: low strength, frost action, shrink-swell.	Unsuited	Unsuited	Fair: thin layer, too clayey.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bullnel:				
BnC2	Fair: low strength, frost action.	Unsuited	Unsuited	Poor: small stones.
BnG	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Burgi:				
BuG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope.
Caballo:				
CaG	Poor: area reclaim, slope.	Unsuited	Unsuited	Poor: area reclaim, slope, small stones.
Canburn:				
Cb	Poor: wetness, frost action.	Unsuited	Unsuited	Poor: wetness.
Causey:				
CdG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
[1]CeG:				
Causey part	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Choptie part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
Charcol:				
ChG	Poor: slope.	Unsuited	Unsuited	Poor: small stones, slope.
Cloud Rim:				
CnG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Condie:				
CoG	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Cristo:				
[1]CrG:				
Cristo part	Poor: slope, thin layer.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: slope.
Wallsburg part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Crooked Creek:				
Ct	Poor: wetness, low strength, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Croydon:				
CvG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Cumulic Haploborolls:				
CW	Poor: wetness.	Unsuited	Unsuited	Poor: wetness.
Cumulic Haploxerolls:				
CX		Unsuited	Unsuited	
Donner:				
DaG	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, small stones.
[1]DbE:				
Donner part	Poor: low strength, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, small stones.
Bertag part	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
Durfee:				
DeG	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope, small stones, large stones.
[1]DmG:				
Durfee part	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope, small stones, large stones.
Moweba part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Durst:				
DuG	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
Eastcan:				
EaA, EcA	Poor: frost action, low strength.	Unsuited	Unsuited	Good.
Eastcan variant:				
EdC, EeC	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope, thin layer.
Ercan:				
ErD	Fair: frost action, low strength, shrink-swell.	Unsuited	Unsuited	Fair: slope.
ErE	Fair: low strength, slope, frost action.	Unsuited	Unsuited	Poor: slope.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ercan:				
ErG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Etchen:				
EtG	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
[1]EVG:				
Etchen part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Henhoit part	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones, area reclaim.
[1]EXG:				
Etchen part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Schuster part	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
Fluvaquentic Haploborolls:				
[1]FAB:				
Fluvaquentic Haploborolls part	Poor: wetness.			Poor: wetness.
Fluventic Haploxerolls part.				
Flygare:				
FcG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Foxol:				
[1]FdG:				
Foxol part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, small stones.
Durfee part	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope, small stones, large stones.
[1]FrG:				
Foxol part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, small stones.
Rock outcrop part.				
Geertsen:				
GaG	Poor: slope.	Unsuited	Unsuited	Poor: thin layer, slope, small stones.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Geertsen:				
[1]GcG:				
Geertsen part	Poor: slope.	Unsuited	Unsuited	Poor: thin layer, slope, small stones.
Agassiz part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, thin layer.
Guilder:				
GeE	Poor: low strength.	Unsuited	Unsuited	Poor: slope.
Hades:				
HaC	Fair: shrink-swell, low strength, frost action.	Unsuited	Unsuited	Fair: slope, small stones.
HaG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Hawkins:				
HbC, HbD	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
HbE	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, too clayey.
[1]HcE:				
Hawkins part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Collinston part	Poor: frost action.	Unsuited	Unsuited	Poor: slope.
Henefer:				
HeD	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: slope.
HeG	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
Henhoit:				
HpG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones, area reclaim.
Herd:				
HrC	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: small stones.
[1]HtC:				
Herd part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: small stones.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Herd:				
[1]HtC:				
Yence part	Poor: low strength, area reclaim.	Unsuited	Unsuited	Poor: large stones, small stones, area reclaim.
Holmes:				
HuC	Fair: frost action.	Unsuited	Fair: excess fines.	Poor: large stones, small stones.
Horrocks:				
[1]HvG:				
Horrocks part	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: slope, small stones.
Rock outcrop part.				
Hoskin:				
HwG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones, area reclaim.
[1]HxG:				
Hoskin part	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones, area reclaim.
Rock outcrop part.				
Isbell:				
IbG	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope.
IgD	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Fair: slope.
Kahler:				
KaB, KaC	Fair: low strength, frost action, shrink-swell.	Unsuited	Unsuited	Poor: small stones.
Kilfoil:				
KfF	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
[1]KrG:				
Kilfoil part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
Rock outcrop part.				
Lamondi:				
LaD	Fair: low strength, frost action.	Unsuited	Unsuited	Poor: large stones.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Lamondi:				
LaE	Fair: slope, low strength, frost action.	Unsuited	Unsuited	Poor: slope, large stones.
Lithic Haploxerolls:				
[1]LHG:				
Lithic Haploxerolls part	Poor: slope, thin layer.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: slope, thin layer, small stones.
Rock outcrop part.				
Lucky Star:				
LkD	Fair: slope, frost action, low strength.	Unsuited	Unsuited	Poor: slope.
LkG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
[1]LmG:				
Lucky Star part	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Charcol part	Poor: slope.	Unsuited	Unsuited	Poor: small stones, slope.
[1]LNG:				
Lucky Star part	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Ercan part	Fair: low strength, slope, frost action.	Unsuited	Unsuited	Poor: slope.
Manila:				
MbA, MbB, MbC	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: thin layer.
MbD	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope, thin layer.
MbE	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope, thin layer.
[1]McD:				
Manila part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope, thin layer.
Yeates Hollow part	Fair: slope, large stones.	Unsuited	Unsuited	Poor: large stones, small stones, slope.
[1]McG:				
Manila part	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope, thin layer.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Manila:				
[1]McG:				
Yeates Hollow part	Poor: slope.	Unsuited	Unsuited	Poor: large stones, small stones, slope.
Mondey:				
MeD	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: slope, too clayey.
MeE	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.
Morgala:				
MoG	Poor: slope, low strength, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim, thin layer.
[1]MrG:				
Morgala part	Poor: slope, low strength, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim, thin layer.
Rock outcrop part.				
Moweba:				
MwC	Fair: frost action, low strength.	Unsuited	Unsuited	Poor: small stones.
MwG	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
[1]MyG:				
Moweba part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
St. Marys part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Nagitsy:				
NAE	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones.
[1]NcG:				
Nagitsy part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: large stones, slope.
Rock outcrop part.				
[1]NDG:				
Nagitsy part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: large stones, slope.
Broad Canyon part	Poor: slope, area reclaim.	Poor: large stones, excess fines.	Poor: large stones, excess fines.	Poor: small stones, slope, area reclaim.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Nagitsy:				
[1]NDG:				
Rock outcrop part.				
[1]NPG:				
Nagitsy part	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: large stones, slope.
Patio part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
Rock outcrop part.				
Nebeker:				
NrA, NrB	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer, too clayey.
Nicodemus:				
NsA	Fair: frost action, low strength.	Unsuited	Unsuited	Poor: small stones.
Norcan:				
NtG	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
Nordic:				
NuG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: small stones, slope, area reclaim.
[1]NVG:				
Nordic part	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: small stones, slope, area reclaim.
Patio part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
Ostler:				
OaG	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
[1]OcG:				
Ostler part	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
Causey part	Poor: slope.	Unsuited	Unsuited	Poor: slope.
[1]ODG:				
Ostler part	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
Bertag part	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Parleys:				
PaA	Poor: low strength, frost action.	Unsuited	Unsuited	Good.
Parlo:				
PcA	Poor: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Patio:				
PdG	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
Phoebe:				
PhA	Fair: frost action.	Poor: excess fines.	Unsuited	Good.
Poleline:				
PoG	Poor: slope.	Unsuited	Unsuited	Poor: slope, large stones.
[1]PPG:				
Poleline part	Poor: slope.	Unsuited	Unsuited	Poor: slope, large stones.
Patio part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
Pringle:				
PrA	Fair: wetness, floods.	Unsuited	Good	Poor: wetness.
Redcan:				
[1]RaG:				
Redcan part	Poor: slope, area reclaim, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, area reclaim.
Etchen part	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope, small stones.
[1]RcG:				
Redcan part	Poor: slope, area reclaim, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer, area reclaim.
Rock outcrop part.				
Redola:				
ReA	Fair: frost action, low strength.	Unsuited	Unsuited	Good.
Richens:				
RhC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: slope, small stones.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Richville:				
RvG	Poor: slope, thin layer, area reclaim.	Unsuited	Unsuited	Poor: slope, thin layer, area reclaim.
Rock outcrop: RX.				
Scave:				
SaD	Fair: slope, low strength, frost action.	Unsuited	Unsuited	Poor: slope.
SaG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Schuster:				
ScG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
Sessions:				
SeD	Poor: low strength.	Unsuited	Unsuited	Poor: small stones, slope.
Smarts:				
SfG, SgG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Steed:				
SmA	Good	Poor: excess fines.	Good	Poor: thin layer.
SnA	Good	Poor: excess fines.	Good	Poor: thin layer, small stones.
St. Marys:				
SoG	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
SrG	Poor: slope.	Unsuited	Unsuited	Poor: slope, large stones.
[1]SsD:				
St. Marys part	Fair: slope.	Unsuited	Unsuited	Poor: small stones.
Guilder part	Poor: low strength.	Unsuited	Unsuited	Fair: slope, thin layer.
[1]StG:				
St. Marys part	Poor: slope.	Unsuited	Unsuited	Poor: slope, small stones.
Hoskin part	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, small stones, area reclaim.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Stoda:				
SuD	Fair: slope, low strength, frost action.	Unsuited	Unsuited	Poor: slope.
SuG	Poor: slope.	Unsuited	Unsuited	Poor: slope.
Sunset:				
SwA	Fair: low strength, frost action, wetness.	Unsuited	Unsuited	Good.
Toncana:				
TaG	Poor: slope, area reclaim.	Unsuited	Unsuited	Poor: slope, area reclaim.
Toone:				
TeG	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope.
Trojan:				
TnA	Fair: frost action, low strength, shrink-swell.	Unsuited	Unsuited	Fair: thin layer.
TnD	Fair: frost action, low strength, shrink-swell.	Unsuited	Unsuited	Fair: slope, thin layer.
Utaba:				
UaA, UbA	Good	Poor: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
UcA	Good	Poor: excess fines.	Poor: excess fines.	Poor: thin layer.
Yeates Hollow:				
YaA	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
YbC	Fair: frost action, low strength.	Unsuited	Unsuited	Poor: small stones.
YcD	Fair: slope, large stones.	Unsuited	Unsuited	Poor: large stones, small stones, slope.
[1]YdG:				
Yeates Hollow part	Poor: slope.	Unsuited	Unsuited	Poor: large stones, small stones, slope.
Smarts part	Poor: slope.	Unsuited	Unsuited	Poor: slope.

See footnotes at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Yeljack:				
YeD	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
YeE	Fair: frost action, slope, low strength.	Unsuited	Unsuited	Poor: slope.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 11.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Agassiz:						
[1]AaG:						
Agassiz part	Slope, depth to rock.	Thin layer, large stones.			Slope, depth to rock, large stones.	Slope, rooting depth, droughty.
Rock outcrop part.						
[1]AbG:						
Agassiz part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth, droughty.
Rock outcrop part.						
[1]AGG:						
Agassiz part	Slope, depth to rock.	Thin layer, large stones.			Slope, depth to rock, large stones.	Slope, rooting depth, droughty.
Geertsen part	Slope, depth to rock.	Thin layer, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Rock outcrop part.						
Ant Flat:						
AnD	Slope	Low strength, hard to pack, compressible.			Slope, percs slowly.	Slope, percs slowly.
Bertag:						
BAF, BbG, BcE	Slope	Low strength, piping.			Slope, piping, percs slowly.	Slope, percs slowly.
Broad Canyon:						
BdG	Slope, seepage.	Seepage, large stones, piping.			Slope, large stones.	Slope, large stones, droughty.
Broadhead:						
BeB	Slope	Low strength, hard to pack, shrink-swell.	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
Brownlee:						
BfA	Favorable	Low strength, piping, hard to pack.	Percs slowly	Percs slowly	Piping, percs slowly.	Percs slowly.
BfB	Slope	Low strength, piping, hard to pack.	Slope, percs slowly.	Slope, percs slowly.	Slope, piping, percs slowly.	Slope, percs slowly.
Bullnel:						
BnC2, BnG	Depth to rock, slope.	Low strength, thin layer.			Slope, depth to rock.	Slope, rooting depth.
Burgi:						
BuG	Slope, seepage.	Piping			Slope	Slope, droughty.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Caballo:						
CaG	Slope	Hard to pack, low strength.			Slope	Slope, piping.
Canburn:						
Cb	Favorable	Low strength, hard to pack.	Poor outlets, percs slowly, floods.	Wetness, floods, percs slowly.	Wetness	Wetness.
Causey:						
CdG	Slope	Low strength, piping.			Slope	Slope.
[1]CeG:						
Causey part	Slope	Low strength, piping.			Slope	Slope.
Choptie part	Slope, depth to rock.	Low strength, piping, thin layer.			Complex slope, depth to rock, erodes easily.	Rooting depth, erodes easily.
Charcol:						
ChG	Slope, seepage.	Low strength, piping.			Slope	Slope.
Cloud Rim:						
CnG	Slope	Low strength, piping.			Slope	Slope.
Condie:						
CoG	Slope, seepage.	Favorable			Slope	Slope.
Cristo:						
[1]CrG:						
Cristo part	Depth to rock, slope.	Low strength, piping, hard to pack.			Slope, percs slowly, depth to rock.	Slope, rooting depth.
Wallsburg part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Crooked Creek:						
Ct	Favorable	Low strength, shrink-swell, hard to pack.	Wetness, percs slowly, floods.	Wetness, percs slowly, floods.	Wetness, percs slowly.	Wetness, percs slowly.
Croydon:						
CvG	Slope	Hard to pack, low strength, piping.			Slope	Slope.
Cumulic Haploborolls:						
CW	Slope		Floods, wetness.	Slope, wetness, floods.	Slope, wetness.	Slope, wetness.
Cumulic Haploxerolls:						
CX	Slope		Floods	Floods, slope.	Slope	Slope.
Donner:						
DaG	Slope, depth to rock.	Low strength, hard to pack, thin layer.			Slope, percs slowly.	Slope, rooting depth.
[1]DbE:						
Donner part	Slope, depth to rock.	Low strength, hard to pack, thin layer.			Slope, percs slowly.	Slope, rooting depth.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Donner:						
[1]DbE:						
Bertag part	Slope	Low strength, piping.			Slope, piping, percs slowly.	Slope, percs slowly.
Durfee:						
DeG	Slope	Hard to pack, low strength.			Slope, percs slowly.	Slope, percs slowly, large stones.
[1]DmG:						
Durfee part	Slope	Hard to pack, low strength.			Slope, percs slowly.	Slope, percs slowly, large stones.
Moweba part	Slope, seepage.	Low strength, piping, hard to pack.			Slope, piping.	Slope.
Durst:						
DuG	Slope, depth to rock.	Thin layer			Slope, depth to rock, percs slowly.	Slope, percs slowly, rooting depth.
Eastcan:						
EaA, EcA	Seepage	Low strength, piping.	Favorable	Wetness, floods.	Favorable	Wetness.
Eastcan variant:						
EdC, EeC	Slope	Excess humus, low strength, piping.	Slope	Slope	Slope	Slope.
Ercan:						
ErD, ErE, ErG	Slope	Low strength, piping.			Slope, piping.	Slope.
Etchen:						
EtG	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
[1]EVG:						
Etchen part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Henhoit part	Slope	Low strength			Slope, percs slowly.	Slope, percs slowly.
[1]EXG:						
Etchen part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Schuster part	Slope	Low strength			Slope	Slope.
Fluvaquentic Haploborolls:						
[1]FAB:						
Fluvaquentic Haploborolls part	Slope		Floods, wetness, slope.	Floods, wetness, slope.	Wetness, slope.	Wetness, slope.
Fluventic Haploxerolls part	Floods		Floods, slope.	Floods, slope.	Slope	Slope.
Flygare:						
FcG	Slope, seepage.	Low strength, piping.			Slope	Slope.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Foxol:						
[1]FdG:						
Foxol part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Durfee part	Slope	Hard to pack, low strength.			Slope, percs slowly, large stones.	Slope, percs slowly, large stones.
[1]FrG:						
Foxol part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.						
Geertsen:						
GaG	Slope, depth to rock.	Thin layer, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
[1]GcG:						
Geertsen part	Slope, depth to rock.	Thin layer, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Agassiz part	Slope, depth to rock.	Thin layer, large stones.			Slope, depth to rock, large stones.	Slope, rooting depth, droughty.
Guilder:						
GeE	Slope	Low strength, piping.			Slope, piping, percs slowly.	Slope, percs slowly.
Hades:						
HaC, HaG	Slope	Low strength, shrink-swell, piping.			Slope, percs slowly, piping.	Slope, percs slowly.
Hawkins:						
HbC, HbD, HbE	Slope	Shrink-swell, low strength, hard to pack.	Slope, percs slowly.	Slope, percs slowly, slow intake.	Slope, percs slowly.	Slope, percs slowly.
[1]HcE:						
Hawkins part	Slope	Shrink-swell, low strength, hard to pack.	Slope, percs slowly.	Slope, percs slowly, slow intake.	Slope, percs slowly.	Slope, percs slowly.
Collinston part	Slope, seepage.	Piping, hard to pack, low strength.	Slope	Slope, erodes easily.	Slope, piping.	Slope.
Henefer:						
HeD	Slope	Low strength, piping.	Slope, percs slowly.	Slope, percs slowly, erodes easily.	Slope, percs slowly.	Slope, percs slowly.
HeG	Slope	Low strength, piping.			Slope, percs slowly.	Slope, percs slowly.
Henhoit:						
HpG	Slope	Low strength			Slope, percs slowly.	Slope, percs slowly.
Herd:						
HrC	Slope	Low strength, hard to pack, piping.			Slope, percs slowly, piping.	Slope, percs slowly.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Herd:						
[1]HtC:						
Herd part	Slope	Low strength, hard to pack, piping.			Slope, percs slowly, piping.	Slope, percs slowly.
Yence part	Slope, depth to rock.	Large stones, shrink-swell, low strength.			Slope, percs slowly, large stones.	Slope, percs slowly, large stones.
Holmes:						
HuC	Slope, seepage.	Large stones, seepage, piping.			Slope, large stones.	Slope, large stones, droughty.
Horrocks:						
[1]HvG:						
Horrocks part	Slope, seepage, depth to rock.	Low strength, piping, seepage.			Slope, piping.	Slope, droughty.
Rock outcrop part.						
Hoskin:						
HwG	Slope, seepage, depth to rock.	Low strength, thin layer, piping.			Slope, depth to rock.	Slope, rooting depth, small stones.
[1]HxG:						
Hoskin part	Slope, seepage, depth to rock.	Low strength, thin layer, piping.			Slope, depth to rock.	Slope, rooting depth, small stones.
Rock outcrop part.						
Isbell:						
IbG, IgD	Slope	Low strength, piping.			Slope, percs slowly, piping.	Slope, percs slowly.
Kahler:						
KaB, KaC	Slope	Low strength, piping, hard to pack.	Slope	Slope, erodes easily.	Favorable	Favorable.
Kilfoil:						
KfF	Slope, depth to rock.	Low strength, piping.			Slope, depth to rock.	Slope, rooting depth.
[1]KrG:						
Kilfoil part	Slope, depth to rock.	Low strength, piping.			Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.						
Lamondi:						
LaD, LaE	Slope, seepage.	Piping, large stones, low strength.			Slope, large stones.	Slope, large stones.
Lithic Haploxerolls:						
[1]LHG:						
Lithic Haploxerolls part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, depth to rock.
Rock outcrop part.						

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Lucky Star:						
LkD, LkG	Slope, seepage.	Thin layer, seepage.			Slope	Slope, droughty.
[1]LmG:						
Lucky Star part	Slope, seepage.	Thin layer, seepage.			Slope	Slope, droughty.
Charcol part	Slope, seepage.	Low strength, piping.			Slope	Slope, droughty.
[1]LNG:						
Lucky Star part	Slope, seepage.	Thin layer, seepage.			Slope	Slope, droughty.
Ercan part	Slope	Low strength, piping.			Slope, piping.	Slope.
Manila:						
MbA	Favorable	Low strength, hard to pack.	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
MbB, MbC, MbD, MbE	Slope	Low strength, hard to pack.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
[1]McD:						
Manila part	Slope	Low strength, hard to pack:	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
Yeates Hollow part	Depth to rock, slope.	Large stones, low strength.			Large stones, depth to rock, slope.	Large stones, percs slowly, slope.
[1]McG:						
Manila part	Slope	Low strength, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Yeates Hollow part	Depth to rock, slope.	Large stones, low strength.			Large stones, depth to rock, slope.	Large stones, percs slowly, slope.
Mondey:						
MeD, MeE	Slope	Hard to pack, low strength, piping.	Slope, percs slowly.	Slope, slow intake.	Slope, percs slowly.	Slope, percs slowly.
Morgala:						
MoG	Slope	Low strength, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
[1]MrG:						
Morgala part	Slope	Low strength, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Rock outcrop part.						
Moweba:						
MwC, MwG	Slope, seepage.	Low strength, piping, hard to pack.			Slope, piping.	Slope.
[1]MyG:						
Moweba part	Slope, seepage.	Low strength, piping, hard to pack.			Slope, piping.	Slope.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Moweba:						
[1]MyG:						
St. Marys part	Slope, seepage.	Seepage			Slope	Slope, droughty.
Nagitsy:						
NAE	Slope, depth to rock.	Thin layer, seepage, hard to pack.			Slope, depth to rock, erodes easily.	Slope, erodes easily, rooting depth.
[1]NcG:						
Nagitsy part	Slope, depth to rock.	Thin layer, hard to pack, seepage.			Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.						
[1]NDG:						
Nagitsy part	Slope, depth to rock.	Thin layer, hard to pack, seepage.			Slope, depth to rock, erodes easily.	Slope, erodes easily, rooting depth.
Broad Canyon part	Slope, seepage.	Seepage, large stones, piping.			Slope, large stones.	Slope, large stones, droughty.
Rock outcrop part.						
[1]NPG:						
Nagitsy part	Slope, depth to rock.	Thin layer, hard to pack, seepage.			Slope, depth to rock.	Slope, rooting depth.
Patio part	Depth to rock, slope.	Hard to pack, thin layer.			Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.						
Nebeker:						
NrA	Favorable	Low strength, hard to pack, piping.	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
NrB	Slope	Low strength, hard to pack, piping.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
Nicodemus:						
NsA	Seepage	Low strength, piping.	Floods, wetness.	Seepage, wetness, floods.	Wetness, piping.	Wetness.
Norcan:						
NtG	Slope	Low strength, piping, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Nordic:						
NuG	Slope	Low strength, piping.			Slope, piping.	Slope.
[1]NVG:						
Nordic part	Slope	Low strength, piping.			Slope, piping.	Slope.
Patio part	Depth to rock, slope.	Hard to pack, thin layer.			Slope, depth to rock.	Slope, rooting depth.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ostler:						
OaG	Slope	Low strength, compressible, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
[1]OcG:						
Ostler part	Slope	Low strength, compressible, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Causey part	Slope	Low strength, piping.			Slope	Slope.
[1]ODG:						
Ostler part	Slope	Low strength, compressible, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Bertag part	Slope	Low strength, piping.			Slope, piping, percs slowly.	Slope, percs slowly.
Parleys:						
PaA	Slight	Low strength, piping, hard to pack.	Percs slowly	Percs slowly	Piping	Percs slowly.
Parlo:						
PcA	Seepage	Low strength, piping.	Cutbanks cave, percs slowly.	Percs slowly	Piping	Percs slowly.
Patio:						
PdG	Depth to rock, slope.	Hard to pack			Slope, depth to rock.	Slope, rooting depth.
Phoebe:						
PhA	Seepage	Seepage, piping, erodes easily.	Favorable	Favorable	Piping, erodes easily.	Erodes easily.
Poleline:						
PoG	Slope, seepage.	Seepage, piping, large stones.			Slope, depth to rock, large stones.	Slope, large stones.
[1]PPG:						
Poleline part	Slope, seepage.	Seepage, piping, large stones.			Slope, depth to rock, large stones.	Slope, large stones.
Patio part	Depth to rock, slope.	Hard to pack			Slope, depth to rock.	Slope, rooting depth.
Pringle:						
PrA	Seepage	Piping, seepage, low strength.	Poor outlets, wetness, cutbanks cave.	Wetness, seepage.	Poor outlets, wetness.	Wetness.
Redcan:						
[1]RaG:						
Redcan part	Slope, depth to rock, seepage.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Etchen part	Slope, depth to rock.	Thin layer			Slope, depth to rock.	Slope, rooting depth.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Redcan:						
[1]RcG:						
Redcan part	Slope, depth to rock, seepage.	Thin layer			Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.						
Redola:						
ReA	Seepage	Low strength, piping.	Favorable	Favorable	Favorable	Favorable.
Richens:						
RhC	Slope	Low strength, shrink-swell, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Richville:						
RvG	Slope	Thin layer, piping, low strength.			Slope, erodes easily, depth to rock.	Slope, erodes easily, rooting depth.
Rock outcrop:						
RX.						
Scave:						
SaD, SaG	Slope	Slope, piping.			Slope	Slope.
Schuster:						
ScG	Slope	Low strength			Slope	Slope.
Sessions:						
SeD	Slope	Low strength, hard to pack.			Slope, percs slowly.	Slope, percs slowly.
Smarts:						
SfG	Slope	Low strength, piping, hard to pack.			Slope, piping.	Slope.
SgG	Slope	Low strength, piping, hard to pack.			Slope, piping, depth to rock.	Slope, droughty.
Steed:						
SmA, SnA	Seepage	Thin layer, seepage.	Floods, cutbanks cave.	Droughty, floods.	Favorable	Droughty.
St. Marys:						
SoG	Slope, seepage.	Seepage			Slope	Slope, droughty.
SrG	Slope, seepage.	Large stones, seepage.			Slope, large stones.	Slope, droughty, large stones.
[1]SsD:						
St. Marys part	Slope, seepage.	Seepage			Slope	Slope, droughty.
Guilder part	Slope	Low strength, piping.			Slope, piping, percs slowly.	Slope, percs slowly.
[1]StG:						
St. Marys part	Slope, seepage.	Seepage			Slope	Slope, droughty.

See footnotes at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
St. Marys:						
[1]StG:						
Hoskin part	Slope, seepage, depth to rock.	Low strength, thin layer, piping.			Slope, depth to rock.	Slope, rooting depth, small stones.
Stoda:						
SuD, SuG	Slope, seepage.	Low strength, piping, hard to pack.			Slope, piping.	Slope.
Sunset:						
SwA	Seepage	Low strength, piping, hard to pack.	Floods, wetness, cutbanks cave.	Wetness	Wetness, piping.	Wetness.
Toncana:						
TaG	Slope	Slope, low strength.			Slope	Slope.
Toone:						
TeG	Slope	Hard to pack, piping.			Slope, piping.	Slope.
Trojan:						
TnA	Seepage	Piping, low strength.	Favorable	Favorable	Favorable	Favorable.
TnD	Slope, seepage.	Piping, low strength.	Slope	Slope	Slope	Slope.
Utaba:						
UaA, UbA, UcA	Seepage	Seepage	Floods, cutbanks cave.	Droughty, seepage.	Poor outlets	Droughty.
Yeates Hollow:						
YaA	Slope	Low strength	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
YbC	Slope, depth to rock.	Low strength	Slope, percs slowly.	Slope, percs slowly.	Depth to rock, slope, percs slowly.	Percs slowly, slope.
YcD	Depth to rock, slope.	Large stones, low strength.			Large stones, depth to rock, slope.	Large stones, percs slowly, slope.
[1]YdG:						
Yeates Hollow part	Depth to rock, slope.	Large stones, low strength.			Large stones, depth to rock, slope.	Large stones, percs slowly, slope.
Smarts part	Slope	Low strength, piping, hard to pack.			Slope, piping, depth to rock.	Slope.
Yeljack:						
YeD, YeE	Slope	Piping, low strength.			Slope, piping.	Slope.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Agassiz:											
[1]AaG:											
Agassiz part----	0-8	Stony silt loam	CL-ML	A-4	20-30	80-95	75-90	65-75	50-70	20-30	5-10
	8-14	Very cobbly silty clay loam, very cobbly loam.	CL, CL-ML, GC, GM-GC	A-2, A-4, A-6	30-50	55-75	45-70	40-65	30-60	20-35	5-15
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
[1]AbG:											
Agassiz part----	0-10	Gravelly loam---	GM-GC	A-2, A-4	0-10	50-65	45-60	40-55	30-45	20-30	5-10
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
[1]AGG:											
Agassiz part----	0-8	Stony silt loam	CL-ML	A-4	20-30	80-95	75-90	65-75	50-70	20-30	5-10
	8-14	Very cobbly silty clay loam, very cobbly loam.	CL, CL-ML, GC, GM-GC	A-2, A-4, A-6	30-50	55-75	45-70	40-65	30-60	20-35	5-15
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Geertsen part---	0-10	Loam------------	CL-ML	A-4	0-30	90-100	85-100	70-95	55-75	20-30	5-10
	10-45	Cobbly clay loam, very cobbly clay loam.	GC, CL	A-6	30-60	55-75	50-70	45-70	35-55	30-40	10-15
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Ant Flat:											
AnD---------------	0-10	Loam------------	CL-ML, CL	A-4, A-6	0	80-100	75-100	65-100	50-85	25-35	5-15
	10-26	Clay loam, clay, silty clay.	CL, CH	A-6, A-7	0	80-100	75-100	70-100	55-95	35-60	15-35
	26-60	Clay loam, gravelly loam, gravelly clay loam.	CL, GC	A-6	0	60-100	55-100	50-100	40-80	30-40	10-20
Bertag:											
BAF, BbG----------	0-24	Silt loam-------	CL-ML	A-4	0	85-100	80-100	65-100	50-90	20-30	5-10
	24-60	Silty clay loam, silty clay, gravelly silty clay.	CL	A-6, A-7	0-15	85-100	75-100	70-100	60-95	35-50	15-30
BcE---------------	0-25	Cobbly loam-----	CL-ML	A-4	25-40	95-100	80-95	65-95	50-75	20-30	5-10
	25-60	Silty clay loam, silty clay, gravelly silty clay.	CL	A-6, A-7	0-15	85-100	75-100	70-100	60-95	35-50	15-30

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Broad Canyon:											
BdG	0-15	Stony loam	SM-SC	A-4	15-35	70-80	60-70	50-65	35-50	20-30	5-10
	15-60	Very gravelly sandy loam, very cobbly sandy loam.	GM	A-1	15-30	45-60	35-50	25-35	10-20	15-25	NP-5
Broadhead:											
BeB	0-17	Clay loam	CL	A-6	0-5	95-100	90-100	75-95	60-80	30-35	10-15
	17-43	Clay, silty clay, clay loam.	CL, CH	A-7	0-10	95-100	90-100	85-100	70-95	40-55	20-30
	43-60	Silt loam, clay loam, clay.	CL	A-6, A-7	5-15	95-100	90-100	85-100	70-95	25-45	10-20
Brownlee:											
BfA, BfB	0-10	Loam	CL-ML	A-4	0	75-100	75-100	60-90	50-75	25-30	5-10
	10-46	Clay loam, loam	CL	A-6	0	75-100	75-100	60-95	50-75	30-40	10-15
	46-63	Stratified loamy sand to silt loam.	ML, CL-ML, SM-SC, SM	A-4	0	75-100	75-100	60-95	45-65	20-30	NP-10
Bullnel:											
BnC2	0-6	Gravelly loam	SM-SC, GM-GC	A-4	0-15	65-80	55-70	45-60	35-50	20-30	5-10
	6-25	Gravelly loam, gravelly silty clay loam.	GM, GC, ML, CL	A-4, A-6	0-15	60-80	55-75	45-70	40-65	30-35	5-15
	25	Weathered bedrock.	---	---	---	---	---	---	---	---	---
BnG	0-8	Gravelly loam	SM-SC, GM-GC	A-4	0-15	65-80	55-70	45-60	35-50	20-30	5-10
	8-39	Gravelly loam, gravelly silty clay loam.	GM, GC, ML, CL	A-4, A-6	0-15	60-80	55-75	45-70	40-65	30-35	5-15
	39	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Burgi:											
BuG	0-20	Loam	CL-ML	A-4	0-5	85-95	80-90	65-80	50-65	20-30	5-10
	20-60	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC, SM-SC	A-2, A-4	5-65	40-75	35-65	30-50	20-40	20-30	5-10
Caballo:											
CaG	0-10	Gravelly loam	GM-GC, CL-ML	A-4	10-30	65-90	60-75	55-70	35-60	20-30	5-10
	10-53	Very cobbly clay loam, cobbly clay loam, very gravelly loam.	GM-GC, GC, CL, CL-ML	A-2, A-4, A-6	40-75	25-90	20-85	15-80	15-60	20-35	5-15
	53	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Canburn:											
Cb	0-21	Silt loam	CL-ML, CL	A-4, A-6	0	100	95-100	85-95	65-80	25-40	5-15
	21-60	Clay loam, loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	90-100	75-95	50-80	20-40	5-15
Causey:											
CdG	0-19	Silt loam	CL-ML	A-4	0	100	100	90-100	70-85	25-30	5-10
	19-40	Loam	CL-ML	A-4	0	90-100	85-100	75-95	60-75	25-30	5-10
	40-63	Gravelly loam, very gravelly loam.	GM-GC, GM, SM-SC, SM	A-2	0	50-70	30-50	20-45	15-35	20-30	NP-10

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Causey:											
[1]CeG:											
Causey part-----	0-19	Silt loam-------	CL-ML	A-4	0	100	100	90-100	70-85	25-30	5-10
	19-40	Loam------------	CL-ML	A-4	0	90-100	85-100	75-95	60-75	25-30	5-10
	40-63	Gravelly loam, very gravelly loam.	GM-GC, GM, SM-SC, SM	A-2	0	50-70	30-50	20-45	15-35	20-30	NP-10
Choptie part----	0-14	Silt loam-------	CL-ML	A-4	0-10	85-100	75-100	65-100	50-80	20-30	5-10
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Charcol:											
ChG---------------	0-21	Gravelly fine sandy loam.	SM-SC, SM	A-2, A-1	0-20	60-75	55-70	35-50	20-30	20-30	NP-10
	21-62	Very gravelly sandy loam, gravelly loam, very cobbly loam.	SM-SC, SM, GM, GM-GC	A-2, A-4, A-1	10-25	50-70	45-65	35-60	15-40	20-30	NP-10
Cloud Rim:											
CnG---------------	0-15	Loam------------	CL	A-6	0-5	90-100	85-95	70-90	60-70	25-40	10-15
	15-56	Loam, cobbly loam, clay loam.	CL, SC	A-6	0-20	75-100	70-90	60-90	40-70	25-40	10-15
	56-66	Gravelly loam, gravelly sandy loam, loam.	CL-ML, GM-GC	A-2, A-4	0-10	40-90	35-85	20-80	15-60	20-30	5-10
Condie:											
CoG---------------	0-25	Gravelly loam---	GM, GM-GC	A-2, A-4	0-25	55-70	50-65	35-60	30-50	20-30	NP-10
	25-42	Gravelly clay loam, gravelly sandy clay loam, cobbly clay loam.	GM, GC, ML, CL	A-2, A-4, A-6	0-40	50-75	50-70	40-65	30-60	30-35	5-15
	42-66	Very gravelly loam, very gravelly sandy loam.	GP-GM, GM, GM-GC	A-2, A-1	0-10	25-40	20-35	10-30	5-25	20-30	NP-10
Cristo:											
[1]CrG:											
Cristo part-----	0-13	Loam------------	CL-ML	A-4	0	85-100	80-100	70-95	50-75	20-30	5-10
	13-21	Clay loam, gravelly silty clay loam.	CL	A-6	0	65-100	60-100	55-100	50-95	30-40	10-15
	21-35	Very gravelly clay loam, very gravelly silty clay loam.	GM, GP-GM	A-2	0	20-40	10-30	5-30	5-25	30-40	5-15
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Wallsburg part--	0-10	Gravelly loam---	GM-GC, GC, SM-SC, SC	A-2, A-4, A-6	10-20	60-80	50-70	40-60	30-50	20-30	5-15
	10-15	Very cobbly clay loam, very cobbly clay, very gravelly silty clay loam.	GC	A-2, A-6, A-7	10-60	55-70	40-65	35-60	25-50	30-45	10-25
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Crooked Creek:											
Ct	0-14	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	75-95	30-45	15-25
	14-52	Clay loam, clay, silty clay.	CL, CH	A-7	0	95-100	95-100	90-100	75-95	40-55	15-30
	52-60	Clay loam, loam	SM-SC, SM, CL-ML, ML	A-4	0	85-100	80-100	65-85	45-75	20-40	5-10
Croydon:											
CvG	0-22	Loam	CL-ML, ML	A-4	0-20	85-100	80-100	55-100	50-80	20-30	NP-10
	22-48	Silty clay loam, gravelly loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-30	85-100	70-100	65-100	45-85	25-40	5-15
	48	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Cumulic Haploborolls:											
CW	0-60	Variable	---	---	---	---	---	---	---	---	---
Cumulic Haploxerolls:											
CX	0-60	Variable	---	---	---	---	---	---	---	---	---
Donner:											
DaG	0-6	Cobbly loam	CL-ML, SM-SC	A-4	30-50	75-90	70-85	50-80	40-65	20-30	5-10
	6-34	Clay loam, clay, silty clay.	CL	A-7	0-15	85-100	80-100	70-100	55-95	40-45	15-20
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]DbE:											
Donner part	0-6	Cobbly loam	CL-ML, SM-SC	A-4	30-50	75-90	70-85	50-80	40-65	20-30	5-10
	6-36	Clay loam, clay, silty clay.	CL	A-7	0-15	85-100	80-100	70-100	55-95	40-45	15-20
	36	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Bertag part	0-12	Cobbly loam	CL-ML	A-4	25-40	95-100	80-95	65-95	50-75	20-30	5-10
	12-60	Silty clay loam, silty clay, gravelly silty clay.	CL	A-6, A-7	0-15	85-100	75-100	70-100	60-95	35-50	15-30
Durfee:											
DeG	0-6	Stony loam	CL-ML, SM-SC	A-4	10-40	75-90	70-85	50-80	40-65	20-30	5-10
	6-16	Very gravelly loam.	GM-GC	A-2, A-4	5-10	45-60	35-50	30-45	25-40	20-30	5-10
	16-60	Very gravelly clay, very cobbly clay, very gravelly clay loam.	CL, CH, GC	A-7	45-80	55-80	45-75	40-70	35-65	40-60	15-45
[1]DmG:											
Durfee part	0-6	Stony loam	CL-ML, SM-SC	A-4	10-40	75-90	70-85	50-80	40-65	20-30	5-10
	6-16	Very gravelly loam.	GM-GC	A-2, A-4	5-10	45-60	35-50	30-45	25-40	20-30	5-10
	16-60	Very gravelly clay, very cobbly clay, very gravelly clay loam.	CL, CH, GC	A-7	45-80	55-80	45-75	40-70	35-65	40-60	15-45

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Durfee:											
[1]DmG:											
Moweba part-----	0-31	Gravelly loam---	CL-ML	A-4	0-25	70-75	65-70	60-65	50-60	20-30	5-10
	31-72	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2	15-60	45-65	40-60	35-55	25-35	20-30	5-10
Durst:											
DuG---------------	0-10	Gravelly loam---	GM-GC	A-4	0-30	65-70	60-65	50-60	35-45	20-30	5-10
	10-25	Gravelly clay loam, very gravelly clay loam, very cobbly loam.	GC	A-2	10-75	40-65	35-60	30-50	25-35	30-40	10-15
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Eastcan:											
EaA, EcA----------	0-13	Loam------------	CL-ML	A-4	0	90-100	85-100	75-95	60-75	20-30	5-10
	13-60	Stratified clay loam to very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	70-80	25-40	5-15
Eastcan variant:											
EdC, EeC----------	0-9	Loam------------	CL-ML	A-4	0	90-100	85-100	75-95	60-75	20-30	5-10
	9-60	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	GM, GC	A-4, A-6	0	55-75	50-70	45-65	35-50	30-40	5-15
Ercan:											
ErD, ErE, ErG-----	0-18	Loam------------	CL-ML	A-4	0	80-100	75-100	65-95	50-75	20-30	5-10
	18-27	Fine sandy loam, loam, cobbly clay loam.	ML, CL-ML, SM, SM-SC	A-4	0-30	75-100	70-100	60-90	40-75	20-30	NP-10
	27-56	Clay loam, sandy clay loam, gravelly clay loam.	CL, GC	A-6	0	60-100	50-100	45-90	35-75	25-35	10-15
	56	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Etchen:											
EtG---------------	0-8	Very cobbly loam	GM-GC	A-2, A-4	50-70	55-75	50-70	40-60	30-50	20-30	5-10
	8-34	Cobbly sandy clay loam, very cobbly sandy clay loam, very gravelly clay loam.	GC, SC	A-2, A-4, A-6	30-70	55-75	45-70	40-60	20-45	25-35	10-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]EVG:											
Etchen part-----	0-4	Very cobbly loam	GM-GC	A-2, A-4	50-70	55-75	50-70	40-60	30-50	20-30	5-10
	4-21	Cobbly sandy clay loam, very cobbly sandy clay loam, very gravelly clay loam.	GC, SC	A-2, A-4, A-6	30-70	55-75	45-70	40-60	20-45	25-35	10-15
	21	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Etchen:											
[1]EVG:											
Henhoit part----	0-10	Gravelly loam---	SM-SC	A-4	0-25	70-80	65-75	60-65	40-50	20-30	5-10
	10-60	Very gravelly clay loam, gravelly clay loam, very cobbly loam.	GM	A-2, A-4, A-6	25-60	45-70	40-65	35-65	30-50	30-40	5-15
[1]EXG:											
Etchen part-----	0-11	Very cobbly loam	GM-GC	A-2, A-4	50-70	55-75	50-70	40-60	30-50	20-30	5-10
	11-26	Cobbly sandy clay loam, very cobbly sandy clay loam, very gravelly clay loam.	GC, SC	A-2, A-4, A-6	30-70	55-75	45-70	40-60	20-45	25-35	10-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Schuster part---	0-16	Loam------------	CL-ML	A-4	0	80-90	75-85	65-80	50-65	20-30	5-10
	16-25	Gravelly fine sandy loam, gravelly loam, very cobbly loam.	GM-GC, SM-SC	A-2, A-4	0-55	60-75	55-70	40-65	25-50	15-30	5-10
	25-60	Gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC	A-2, A-6	10-55	30-60	25-55	20-55	15-45	30-40	10-15
Fluvaquentic Haploborolls:											
[1]FAB:											
Fluvaquentic Haploborolls part-----------	0-60	Variable--------	---	---	---	---	---	---	---	---	---
Fluventic Haploxerolls part-----------	0-60	Variable--------	---	---	---	---	---	---	---	---	---
Flygare:											
FcG---------------	0-20	Loam------------	CL-ML	A-4	0-5	90-100	80-90	65-85	50-80	20-30	5-10
	20-36	Cobbly loam, very cobbly loam, cobbly fine sandy loam.	GM-GC	A-2, A-4	30-60	50-70	40-60	35-55	20-40	20-30	5-10
	36-60	Cobbly sandy clay loam, very gravelly clay loam, very cobbly sandy clay loam.	GM-GC	A-2, A-4	25-50	60-75	40-70	35-60	25-50	20-30	5-10
Foxol:											
[1]FdG:											
Foxol part------	0-10	Very cobbly loam	GM-GC	A-2	25-60	40-60	30-45	25-40	20-35	20-30	5-10
	10-16	Very cobbly loam, very gravelly loam.	GM-GC	A-2	20-60	40-60	30-45	25-40	20-35	20-30	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Foxol:											
[1]FdG:											
Durfee part-----	0-6	Stony loam------	CL-ML, SM-SC	A-4	10-40	75-90	70-85	50-80	40-65	20-30	5-10
	6-16	Very gravelly loam.	GM-GC	A-2, A-4	5-10	45-60	35-50	30-45	25-40	20-30	5-10
	16-60	Very gravelly clay, very cobbly clay, very gravelly clay loam.	CL, CH, GC	A-7	45-80	55-80	45-75	40-70	35-65	40-60	15-45
[1]FrG:											
Foxol part------	0-9	Very cobbly loam	GM-GC	A-2	25-60	40-60	30-45	25-40	20-35	20-30	5-10
	9-14	Very cobbly loam, very gravelly loam.	GM-GC	A-2	20-60	40-60	30-45	25-40	20-35	20-30	5-10
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Geertsen:											
GaG---------------	0-8	Loam------------	CL-ML	A-4	0-30	90-100	85-100	70-95	55-75	20-30	5-10
	8-45	Cobbly clay loam, very cobbly clay loam.	GC, CL	A-6	30-60	55-75	50-70	45-70	35-55	30-40	10-15
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]GcG:											
Geertsen part---	0-10	Loam------------	CL-ML	A-4	0-30	90-100	85-100	70-95	55-75	20-30	5-10
	10-48	Cobbly clay loam, very cobbly clay loam.	GC, CL	A-6	30-60	55-75	50-70	45-70	35-55	30-40	10-15
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Agassiz part----	0-8	Stony silt loam	CL-ML	A-4	20-30	80-95	75-90	65-75	50-70	20-30	5-10
	8-14	Very cobbly silty clay loam, very cobbly loam.	CL, CL-ML, GC, GM-GC	A-2, A-4, A-6	30-50	55-75	45-70	40-65	30-60	20-35	5-15
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Guilder:											
GeE---------------	0-12	Loam------------	CL-ML, CL	A-4, A-6	0	90-100	85-100	70-95	60-80	25-35	5-15
	12-31	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	90-100	85-100	75-95	65-95	35-45	10-20
	31-65	Silty clay loam, loam.	CL	A-6, A-7	0	90-100	85-100	70-95	60-95	30-45	10-20
	65	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Hades:											
HaC, HaG----------	0-38	Loam------------	CL-ML	A-4	0	75-100	75-100	60-95	50-75	20-35	5-10
	38-62	Loam, silty clay loam.	CL-ML, CL	A-4, A-6	0-10	75-100	75-100	65-95	50-85	25-40	5-15

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Hawkins:											
HbC, HbD, HbE-----	0-37	Silty clay------	CL, CH	A-7	0	100	95-100	90-100	85-95	40-60	15-30
	37-60	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	100	95-100	90-100	80-95	40-60	15-30
[1]HcE:											
Hawkins part----	0-48	Silty clay------	CL, CH	A-7	0	100	95-100	90-100	85-95	40-60	15-30
	48-60	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	100	95-100	90-100	80-95	40-60	15-30
Collinston part-	0-9	Silt loam-------	CL-ML	A-4	0	100	95-100	80-100	60-90	20-25	5-10
	9-60	Loam, clay loam, silty clay loam.	CL	A-6	0	100	95-100	80-100	75-90	25-35	10-15
Henefer:											
HeD, HeG----------	0-15	Loam------------	CL-ML	A-4	0-5	85-100	80-95	75-90	60-85	20-30	5-10
	15-60	Cobbly clay, gravelly clay loam, gravelly silty clay loam.	CL	A-6, A-7	10-30	75-95	70-95	65-95	60-90	35-50	15-25
Henhoit:											
HpG---------------	0-10	Gravelly loam---	SM-SC	A-4	0-25	70-80	65-75	60-65	40-50	20-30	5-10
	10-60	Very gravelly clay loam, gravelly clay loam, very cobbly loam.	GM	A-2, A-4, A-6	25-60	45-70	40-65	35-65	30-50	30-40	5-15
Herd:											
HrC---------------	0-17	Cobbly clay loam	GM-GC, GC, SM-SC, SC	A-4, A-6	25-45	70-85	65-80	60-70	45-50	25-35	5-15
	17-43	Clay, silty clay	CL, CH	A-7, A-6	0-10	95-100	90-100	80-100	65-95	35-55	15-30
	43	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]HtC:											
Herd part-------	0-20	Cobbly clay loam	GM-GC, GC, SM-SC, SC	A-4, A-6	25-45	70-85	65-80	60-70	45-50	25-35	5-15
	20-36	Clay, silty clay	CL, CH	A-7, A-6	0-10	95-100	90-100	80-100	65-95	35-55	15-30
	36-60	Clay loam-------	CL	A-6	0-10	80-90	75-90	70-85	60-80	25-35	10-15
Yence part------	0-9	Very stony loam	CL-ML, CL, GM-GC, GC	A-2, A-4, A-6	15-35	45-85	40-80	35-70	30-60	20-30	5-15
	9-42	Very cobbly clay, very gravelly clay, very gravelly clay loam.	GC	A-2, A-6, A-7	15-55	35-55	30-50	25-45	20-40	35-50	15-30
	42	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Holmes:											
HuC---------------	0-11	Very stony loam	GM-GC	A-2, A-4	20-50	55-70	50-65	30-55	20-45	20-30	5-10
	11-60	Very gravelly loam, very gravelly sandy loam, very cobbly clay loam.	GM-GC	A-2	10-60	45-60	35-50	25-45	15-35	20-30	5-10
Horrocks:											
[1]HvG:											
Horrocks part---	0-15	Gravelly loam---	SM-SC	A-4	10-20	80-95	60-70	55-65	40-45	20-30	5-10
	15-45	Very cobbly sandy clay loam.	GM-GC, SM-SC	A-2	50-65	55-75	50-60	35-45	20-35	20-30	5-10
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Hoskin:											
HwG---------------	0-19	Cobbly loam-----	SM-SC, CL-ML	A-4	25-40	75-85	60-80	50-75	40-60	20-30	5-10
	19-39	Very cobbly loam, cobbly sandy clay loam, very cobbly clay loam.	GM-GC, GC	A-2, A-4, A-6	25-60	50-65	45-60	40-55	30-50	20-35	5-15
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]HxG:											
Hoskin part-----	0-14	Cobbly loam-----	SM-SC, CL-ML	A-4	25-40	75-85	60-80	50-75	40-60	20-30	5-10
	14-39	Very cobbly loam, cobbly sandy clay loam, very cobbly clay loam.	GM-GC, GC	A-2, A-4, A-6	25-60	50-65	45-60	40-55	30-50	20-35	5-15
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Isbell:											
IbG---------------	0-8	Loam------------	CL-ML	A-4	0-10	90-100	85-100	70-95	60-75	20-30	5-10
	8-25	Clay loam, silty clay loam.	CL	A-6	0-10	85-100	80-100	75-95	65-85	30-40	10-20
	25-60	Loam, silty clay	CL	A-6, A-7	0-10	85-100	80-100	75-95	65-85	30-45	10-20
IgD---------------	0-17	Loam------------	CL-ML	A-4	0	75-100	70-100	65-85	50-70	20-30	5-10
	17-50	Clay loam-------	CL	A-6	0	75-100	70-95	65-90	50-75	30-35	10-15
	50-60	Very cobbly loam, gravelly sandy loam.	GM-GC	A-2	0-55	40-65	35-60	25-40	15-30	25-30	5-10
Kahler:											
KaB, KaC----------	0-28	Gravelly loam---	ML	A-4	0-10	90-95	85-90	70-90	50-85	30-40	5-10
	28-73	Loam, gravelly loam, clay loam.	ML, SM	A-4	0-15	75-95	65-90	50-90	40-80	30-40	5-10

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Kilfoil:											
KfF	0-3	Loam	CL-ML	A-4	0	75-100	75-90	60-80	50-70	20-30	5-10
	3-19	Clay loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0-25	75-100	75-100	70-95	50-80	25-35	5-15
	19-37	Gravelly loam, very gravelly silt loam, cobbly loam.	GM-GC, GC	A-4, A-2	0-45	35-75	30-70	25-60	20-50	20-30	5-10
	37	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]KrG:											
Kilfoil part	0-3	Loam	CL-ML	A-4	0	75-100	75-90	60-80	50-70	20-30	5-10
	3-21	Clay loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0-25	75-100	75-100	70-95	50-80	25-35	5-15
	21-30	Gravelly loam, very gravelly silt loam, cobbly loam.	GM-GC, GC	A-4, A-2	0-45	35-75	30-70	25-60	20-50	20-30	5-10
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Lamondi:											
LaD, LaE	0-21	Stony loam	GM-GC, SM-SC	A-2, A-4	15-25	55-85	50-80	40-65	30-50	20-30	5-10
	21-61	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC, GC	A-2, A-4, A-6	30-65	50-55	40-50	35-45	30-40	25-35	5-15
Lithic Haploxerolls:											
[1]LHG:											
Lithic Haploxerolls part	0-14	Variable	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Lucky Star:											
LkD, LkG	0-20	Silt loam	CL-ML	A-4	0-10	95-100	90-100	85-90	70-85	20-30	5-10
	20-60	Very cobbly sandy clay loam, very cobbly fine sandy loam, gravelly loam.	SM-SC, SM	A-2, A-4, A-1	15-60	60-75	50-65	20-60	10-50	15-30	NP-10
[1]LmG:											
Lucky Star part	0-19	Silt loam	CL-ML	A-4	0-10	95-100	90-100	85-90	70-85	20-30	5-10
	19-74	Very cobbly sandy clay loam, very cobbly fine sandy loam, gravelly loam.	SM-SC, SM	A-2, A-4, A-1	15-60	60-75	50-65	20-60	10-50	15-30	NP-10
Charcol part	0-27	Gravelly fine sandy loam.	SM-SC, SM	A-2, A-1	0-20	60-75	55-70	35-50	20-30	20-30	NP-10
	27-72	Very gravelly sandy loam, gravelly loam, very cobbly loam.	SM-SC, SM, GM, GM-GC	A-2, A-4, A-1	30-55	50-70	45-65	35-60	15-40	20-30	NP-10

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Lucky Star:											
[1]LNG:											
Lucky Star part	0-19	Silt loam	CL-ML	A-4	0-10	95-100	90-100	85-90	70-85	20-30	5-10
	19-74	Very cobbly sandy clay loam, very cobbly fine sandy loam, gravelly loam.	SM-SC, SM	A-2, A-4, A-1	15-60	60-75	50-65	20-60	10-50	15-30	NP-10
Ercan part	0-31	Loam	CL-ML	A-4	0	80-100	75-100	65-95	50-75	20-30	5-10
	31-39	Fine sandy loam, loam, cobbly clay loam.	ML, CL-ML, SM, SM-SC	A-4	0-30	75-100	70-100	60-90	40-75	20-30	NP-10
	39-60	Clay loam, sandy clay loam, gravelly clay loam.	CL, GC	A-6	0	60-100	50-100	45-90	35-75	25-35	10-15
Manila:											
MbA, MbB, MbC, MbD, MbE	0-17	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	70-90	25-35	5-15
	17-60	Clay, silty clay, clay loam.	CL, CH	A-7	0-5	100	95-100	85-100	75-90	40-60	15-30
[1]McD:											
Manila part	0-11	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	70-90	25-35	5-15
	11-50	Clay, silty clay, clay loam.	CL, CH	A-7	0-5	100	95-100	85-100	75-90	40-60	15-30
	50-62	Cobbly loam, cobbly clay loam, silty clay loam.	CL	A-6	5-50	80-100	75-100	70-100	50-95	25-40	10-25
Yeates Hollow part	0-13	Very stony loam	GM-GC, GC, CL-ML, CL	A-4, A-6	45-75	65-85	65-80	55-75	45-70	25-40	5-15
	13-42	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]McG:											
Manila part	0-17	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	70-90	25-35	5-15
	17-60	Clay, silty clay, clay loam.	CL, CH	A-7	0-5	100	95-100	85-100	75-90	40-60	15-30
Yeates Hollow part	0-13	Very stony loam	GM-GC, GC, CL-ML, CL	A-4, A-6	45-75	65-85	65-80	55-75	45-70	25-40	5-15
	13-42	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Nagitsy:											
[1]NDG:											
Nagitsy part----	0-8	Stony loam------	GM-GC, CL-ML	A-4	20-45	60-85	55-80	50-70	35-55	20-30	5-10
	8-28	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2, A-4	10-60	50-60	40-55	30-50	25-45	20-30	5-10
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Broad Canyon part-----------	0-14	Stony loam------	SM-SC	A-4	15-35	70-80	60-70	50-65	35-50	20-30	5-10
	14-60	Very gravelly sandy loam, very cobbly sandy loam.	GM	A-1	15-40	45-60	35-50	25-35	10-20	15-25	NP-5
Rock outcrop part.											
[1]NPG:											
Nagitsy part----	0-15	Stony loam------	GM-GC, CL-ML	A-4	20-45	60-85	55-80	50-70	35-55	20-30	5-10
	15-39	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2, A-4	10-60	50-60	40-55	30-50	25-45	20-30	5-10
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Patio part------	0-13	Gravelly loam---	GM-GC, CL-ML	A-2, A-4	0-25	55-70	50-65	35-60	30-55	20-30	5-10
	13-26	Very gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC, GM-GC	A-2	10-60	30-55	25-50	20-40	15-35	25-35	5-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Nebeker:											
NrA, NrB----------	0-20	Clay loam-------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-100	75-95	25-40	5-20
	20-60	Clay, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	90-100	80-95	35-55	15-30
Nicodemus:											
NsA---------------	0-8	Gravelly loam---	SM-SC	A-4	0	70-85	60-80	50-65	35-50	20-30	5-10
	8-22	Gravelly clay loam, cobbly clay loam.	CL-ML, CL	A-4, A-6	5-40	70-80	65-75	60-75	50-60	25-35	5-15
	22-60	Stratified gravelly loam to very gravelly loamy sand.	GM, GP-GM	A-1	30-40	40-50	30-40	15-30	5-20	20-30	NP-5
Norcan:											
NtG---------------	0-15	Loam------------	CL-ML	A-4	0	90-100	85-100	70-90	55-75	20-30	5-10
	15-60	Clay loam, silty clay loam, clay.	CL, MH	A-7	0	90-100	85-100	75-100	60-90	40-55	15-25

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mondey:											
MeD, MeE----------	0-9	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	30-40	10-15
	9-31	Clay, silty clay	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	31-60	Loam, clay loam	CL	A-6, A-7	0	100	100	85-100	60-95	30-45	10-20
Morgala:											
MoG---------------	0-4	Loam------------	CL, CL-ML	A-4, A-6	0-15	95-100	90-100	75-95	55-80	25-35	5-15
	4-39	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0-25	80-100	75-100	70-95	60-90	35-45	10-20
	39-60	Gravelly clay loam, gravelly silty clay loam, clay loam.	CL	A-6, A-7	0-20	70-100	65-100	60-95	50-85	30-45	10-20
[1]MrG:											
Morgala part----	0-15	Loam------------	CL, CL-ML	A-4, A-6	0-15	95-100	90-100	75-95	55-80	25-35	5-15
	15-60	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0-25	80-100	75-100	70-95	60-90	35-45	10-20
Rock outcrop part.											
Moweba:											
MwC, MwG----------	0-24	Gravelly loam---	CL-ML	A-4	0-25	70-75	65-70	60-65	50-60	20-30	5-10
	24-60	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2	15-60	45-65	40-60	35-55	25-35	20-30	5-10
[1]MyG:											
Moweba part-----	0-30	Gravelly loam---	CL-ML	A-4	0-25	70-75	65-70	60-65	50-60	20-30	5-10
	30-65	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2	15-60	45-65	40-60	35-55	25-35	20-30	5-10
St. Marys part--	0-14	Cobbly loam-----	GM-GC, SM-SC	A-2, A-4	5-30	60-80	50-70	40-60	25-50	15-25	5-10
	14-60	Very cobbly fine sandy loam, very cobbly loam, gravelly fine sandy loam.	GM	A-2, A-4	25-75	55-70	50-65	40-60	25-50	15-25	NP-5
Nagitsy:											
NAE---------------	0-23	Gravelly loam---	GM	A-2	5-25	40-55	35-50	30-45	25-35	20-30	NP-5
	23	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]NcG:											
Nagitsy part----	0-15	Stony loam------	GM-GC, CL-ML	A-4	20-45	60-85	55-80	50-70	35-55	20-30	5-10
	15-39	Gravelly loam, very gravelly loam, very cobbly loam.	GM-GC	A-2, A-4	10-60	50-60	40-55	30-50	25-45	20-30	5-10
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Nordic:											
NuG	0-15	Gravelly loam	GM-GC, CL-ML	A-4	0	65-75	60-70	50-65	35-60	20-30	5-10
	15-40	Gravelly loam, gravelly clay loam.	GM	A-4, A-6	0-10	55-65	50-60	45-55	35-50	30-40	5-15
	40-70	Gravelly clay loam, very gravelly clay loam, very cobbly loam.	GM	A-2, A-4, A-6	20-60	45-65	40-60	35-55	30-50	30-40	5-15
[1]NVG:											
Nordic part	0-15	Gravelly loam	GM-GC, CL-ML	A-4	0	65-75	60-70	50-65	35-60	20-30	5-10
	15-40	Gravelly loam, gravelly clay loam.	GM	A-4, A-6	0-10	55-65	50-60	45-55	35-50	30-40	5-15
	40-70	Gravelly clay loam, very gravelly clay loam, very cobbly loam.	GM	A-2, A-4, A-6	20-60	45-65	40-60	35-55	30-50	30-40	5-15
Patio part	0-16	Gravelly loam	GM-GC, CL-ML	A-2, A-4	0-15	55-70	50-65	35-60	30-55	20-30	5-10
	16-35	Very gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC, GM-GC	A-2	10-60	30-55	25-50	20-40	15-35	25-35	5-15
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ostler:											
OaG	0-18	Loam	CL-ML, CL	A-4, A-6	0-10	95-100	90-100	80-95	60-80	25-40	5-15
	18-60	Clay, silty clay, clay loam.	CL, CH	A-7	0	95-100	95-100	90-100	80-95	40-60	15-30
[1]OcG:											
Ostler part	0-10	Loam	CL-ML, CL	A-4, A-6	0-10	95-100	90-100	80-95	60-80	25-40	5-15
	10-48	Clay, silty clay, clay loam.	CL, CH	A-7	0	95-100	95-100	90-100	80-95	40-60	15-30
	48	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Causey part	0-19	Silt loam	CL-ML	A-4	0	100	100	90-100	70-85	25-30	5-10
	19-40	Loam	CL-ML	A-4	0	90-100	85-100	75-95	60-75	25-30	5-10
	40-63	Gravelly loam, very gravelly loam.	GC-GM, GM, SC-SM, SM	A-2	0	50-70	30-50	20-45	15-35	20-30	NP-10
[1]ODG:											
Ostler part	0-18	Loam	CL-ML, CL	A-4, A-6	0-10	95-100	90-100	80-95	60-80	25-40	5-15
	18-60	Clay, silty clay, clay loam.	CL, CH	A-7	0	95-100	95-100	90-100	80-95	40-60	15-30
Bertag part	0-18	Silt loam	CL-ML	A-4	0	85-100	80-100	65-100	50-90	20-30	5-10
	18-60	Silty clay loam, silty clay, gravelly silty clay.	CL	A-6, A-7	0-15	85-100	75-100	70-100	60-95	35-50	15-30

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Parleys:											
PaA----------------	0-13	Loam------------	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-95	60-95	20-30	5-15
	13-32	Silty clay loam, clay loam.	ML, CL	A-6, A-7	0	100	95-100	85-100	75-95	35-45	10-20
	32-66	Silt loam, loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	95-100	70-95	50-95	25-35	5-15
Parlo:											
PcA----------------	0-19	Loam------------	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-100	60-80	20-30	5-15
	19-31	Silty clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	85-95	80-90	75-85	30-45	10-20
	31-70	Very gravelly loamy sand, very gravelly sandy loam.	GP-GM, GM	A-1	0-10	25-50	20-40	10-30	5-15	---	NP
Patio:											
PdG----------------	0-13	Gravelly loam---	GM-GC, CL-ML	A-2, A-4	0-25	55-70	50-65	35-60	30-55	20-30	5-10
	13-26	Very gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC, GM-GC	A-2	10-60	30-55	25-50	20-40	15-35	25-35	5-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Phoebe:											
PhA----------------	0-19	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	65-75	30-45	20-30	NP-5
	19-46	Loamy sand------	SM, SP-SM	A-2, A-3	0	90-100	90-95	50-60	5-15	---	NP
	46-60	Sand------------	SP, SP-SM	A-1	0	90-100	90-95	40-50	0-10	---	NP
Poleline:											
PoG----------------	0-24	Stony loam------	CL-ML, SM-SC	A-4	20-40	75-85	70-80	60-70	40-60	20-30	5-10
	24-48	Very gravelly loam, very gravelly sandy loam, very cobbly loam.	GM-GC, GM	A-2, A-4	10-60	40-75	20-65	15-60	10-50	20-35	5-10
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]PPG:											
Poleline part---	0-24	Stony loam------	CL-ML, SM-SC	A-4	20-40	75-85	70-80	60-70	40-60	20-30	5-10
	24-48	Very gravelly loam, very gravelly sandy loam, very cobbly loam.	GM-GC, GM	A-2, A-4	10-60	40-75	20-65	15-60	10-50	20-35	5-10
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Patio part------	0-13	Gravelly loam---	GM-GC, CL-ML	A-2, A-4	0-25	55-70	50-65	35-60	30-55	20-30	5-10
	13-26	Very gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC, GM-GC	A-2	10-60	30-55	25-50	20-40	15-35	25-35	5-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Pringle:											
PrA----------------	0-19	Loam------------	ML, CL-ML	A-4	0	100	100	85-95	50-75	15-25	NP-10
	19-60	Very gravelly sand.	GW, GP	A-1	0-25	30-50	20-40	10-30	0-5	---	NP
Redcan:											
[1]RaG:											
Redcan part-----	0-6	Cobbly loam-----	CL-ML, CL	A-4, A-6	25-35	75-95	70-90	65-80	50-65	25-35	5-15
	6-15	Cobbly loam, gravelly loam, very gravelly loam.	GM-GC, GC	A-2, A-4, A-6	10-20	30-70	25-65	20-60	15-45	25-35	5-15
	15	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Etchen part-----	0-8	Very cobbly loam	GM-GC	A-2, A-4	50-70	55-75	50-70	40-60	30-50	20-30	5-10
	8-34	Cobbly sandy clay loam, very cobbly sandy clay loam, very gravelly clay loam.	GC, SC	A-2, A-4, A-6	30-70	55-75	45-70	40-60	20-45	25-35	10-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]RcG:											
Redcan part-----	0-5	Cobbly loam-----	CL-ML, CL	A-4, A-6	25-35	75-95	70-90	65-80	50-65	25-35	5-15
	5-19	Cobbly loam, gravelly loam, very gravelly loam.	GM-GC, GC	A-2, A-4, A-6	10-20	30-70	25-65	20-60	15-45	25-35	5-15
	19	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Redola:											
ReA---------------	0-24	Loam------------	CL-ML	A-4	0	100	95-100	75-90	50-80	20-30	5-10
	24-60	Stratified sandy loam to loam.	SM-SC, SM, CL-ML, ML	A-4	0	95-100	80-100	60-90	35-60	20-30	NP-10
Richens:											
RhC---------------	0-19	Loam------------	CL-ML, CL	A-4, A-6	0-20	80-95	75-90	65-85	50-70	20-30	5-15
	19-56	Clay, silty clay, gravelly silty clay.	CL, CH	A-6, A-7	0	75-100	70-100	65-100	60-95	35-60	15-30
	56	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Richville:											
RvG---------------	0-4	Gravelly loam---	CL, CL-ML	A-4, A-6	0	65-100	60-100	55-95	50-70	20-30	5-15
	4-28	Loam, clay loam, gravelly clay loam.	CL, CL-ML	A-4, A-6	0-10	80-100	70-100	65-95	50-75	25-35	5-15
	28	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop:											
RX.											

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Scave:											
SaD, SaG	0-14	Loam	CL-ML	A-4	0-20	85-100	75-95	65-90	50-75	20-30	5-10
	14-33	Cobbly loam, very cobbly fine sandy loam.	GM-GC, SM-SC	A-2, A-4	30-60	60-80	50-70	40-65	25-45	20-30	5-10
	33-60	Very cobbly clay, very cobbly clay loam.	GC	A-2, A-6, A-7	50-60	50-70	40-60	35-55	30-50	35-45	15-25
Schuster:											
ScG	0-18	Loam	CL-ML	A-4	0	80-90	75-85	65-80	50-65	20-30	5-10
	18-29	Gravelly fine sandy loam, gravelly loam, very cobbly loam.	GM-GC, SM-SC	A-2, A-4	0-55	60-75	55-70	40-65	25-50	15-30	5-10
	29-63	Gravelly clay loam, very cobbly clay loam, very gravelly loam.	GC	A-2, A-6	10-55	30-60	25-55	20-55	15-45	30-40	10-15
Sessions:											
SeD	0-11	Cobbly loam	CL-ML	A-4	25-35	80-90	70-85	65-80	50-70	20-30	5-10
	11-60	Clay, cobbly clay, gravelly clay loam.	CL	A-6, A-7	0-30	80-100	70-85	70-80	50-75	35-50	15-25
Smarts:											
SfG	0-26	Loam	ML-CL, ML	A-4	0-5	90-100	80-100	75-90	60-75	25-35	5-10
	26-72	Very cobbly loam, very gravelly clay loam, gravelly clay loam.	GM-GC, GC	A-2, A-4, A-6	10-40	50-70	40-60	35-45	30-40	25-40	5-15
SgG	0-28	Loam	ML-CL, ML	A-4	0-5	90-100	80-100	75-90	60-75	25-35	5-10
	28-41	Very cobbly loam, very gravelly clay loam, gravelly clay loam.	GM-GC, GC	A-2,	10-40	50-70	40-60	35-45	30-40	25-40	5-15
	41	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Steed:											
SmA	0-16	Loam	CL-ML, ML	A-4	0	85-95	80-90	60-85	50-60	20-30	NP-10
	16-60	Very gravelly coarse sand, cobbly coarse sand, very gravelly sand.	GP, GW	A-1	5-25	25-50	20-40	5-15	0-5	---	NP
SnA	0-13	Cobbly loam	GM-GC, GM, SM-SC, SM	A-2, A-4	0-25	55-80	50-70	35-60	20-45	20-30	NP-10
	13-62	Very gravelly coarse sand, cobbly coarse sand, very gravelly sand.	GP, GW	A-1	5-25	25-50	20-40	5-15	0-5	---	NP
St. Marys:											
SoG	0-19	Cobbly loam	GM-GC, SM-SC	A-2, A-4	25-35	60-80	50-70	40-60	25-50	15-25	5-10

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
St. Marys:											
SoG	19-60	Very cobbly fine sandy loam, very cobbly loam, gravelly fine sandy loam.	GM	A-2, A-4	25-75	55-70	50-65	40-60	25-50	15-25	NP-5
SrG	0-14	Very stony loam	GM-GC, SM-SC	A-2, A-4	30-75	45-85	40-80	35-75	25-50	15-25	5-10
	14-44	Very cobbly fine sandy loam, very cobbly loam, gravelly fine sandy loam.	GM	A-2, A-4	25-75	55-70	50-65	40-60	25-50	15-25	NP-5
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]SsD:											
St. Marys part	0-19	Gravelly loam	GM-GC, SM-SC	A-2, A-4	5-20	60-80	50-70	40-60	25-50	15-25	5-10
	19-60	Very cobbly fine sandy loam, very cobbly loam, gravelly fine sandy loam.	GM	A-2, A-4	25-75	55-70	50-65	40-60	25-50	15-25	NP-5
Guilder part	0-6	Loam	CL-ML, CL	A-4, A-6	0	90-100	85-100	70-95	60-80	25-35	5-15
	6-27	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	90-100	85-100	75-95	65-95	35-45	10-20
	27-60	Silty clay loam, loam.	CL	A-6, A-7	0	90-100	85-100	70-95	60-95	30-45	10-20
[1]StG:											
St. Marys part	0-10	Cobbly loam	GM-GC, SM-SC	A-2, A-4	25-35	60-80	50-70	40-60	25-50	15-25	5-10
	10-60	Very cobbly fine sandy loam, very cobbly loam, gravelly fine sandy loam.	GM	A-2, A-4	25-75	55-70	50-65	40-60	25-50	15-25	NP-5
Hoskin part	0-7	Cobbly loam	SM-SC, CL-ML	A-4	25-40	75-85	60-80	50-75	40-60	20-30	5-10
	7-28	Very cobbly loam, cobbly sandy clay loam, very cobbly clay loam.	GM-GC, GC	A-2, A-4, A-6	25-60	50-65	45-60	40-55	30-50	20-35	5-15
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Stoda:											
SuD, SuG	0-11	Loam	CL-ML	A-4	0	100	100	85-100	60-85	20-30	5-10
	11-67	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-100	55-80	25-35	5-10

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Sunset:											
SwA----------------	0-17	Loam-------------	ML	A-4	0	90-100	90-100	80-90	60-70	20-30	NP-5
	17-45	Stratified silt loam to loamy fine sand.	ML	A-4	0	85-100	85-100	60-90	50-70	20-30	NP-5
	45-63	Very gravelly sand, very gravelly loamy sand, very gravelly sandy loam.	GW, GP, GM, GP-GM	A-1	0-20	25-50	20-40	10-35	0-20	---	NP
Toncana:											
TaG----------------	0-24	Loam-------------	CL-ML	A-4	0	80-95	75-90	60-80	50-70	20-30	5-10
	24-60	Gravelly clay loam, very gravelly clay loam.	GC	A-2, A-6	15-25	40-60	35-55	30-45	25-40	30-40	10-20
Toone:											
TeG----------------	0-27	Loam-------------	CL, CL-ML	A-4, A-6	0	80-90	75-85	70-75	50-60	25-35	5-15
	27-60	Very cobbly clay loam, gravelly clay loam, very gravelly clay.	GC, GM	A-6, A-7, A-2	30-60	60-70	45-65	40-65	30-50	35-50	10-25
Trojan:											
TnA, TnD-----------	0-11	Loam-------------	CL-ML, SM-SC	A-4	0	80-95	75-90	60-85	45-70	20-30	5-10
	11-50	Gravelly loam, gravelly clay loam.	GM, ML	A-4, A-6	0	55-85	50-75	45-70	35-60	30-40	5-15
	50-60	Very gravelly loamy sand, cobbly clay loam, gravelly clay loam.	GM	A-2, A-1	0-30	40-65	30-60	15-45	5-35	20-40	NP-15
Utaba:											
UaA, UbA-----------	0-8	Cobbly loam------	CL-ML	A-4	25-30	80-90	70-85	65-75	50-60	20-30	5-10
	8-29	Gravelly sandy loam, gravelly loam.	GM, GM-GC	A-1, A-2	5-30	55-65	50-60	30-50	15-30	15-25	NP-10
	29-60	Very gravelly sand, very cobbly sand, very gravelly coarse sandy loam.	GP-GM, GM	A-1	20-60	30-60	25-50	15-40	5-15	---	NP
UcA----------------	0-8	Loam-------------	CL-ML	A-4	0	85-95	80-95	65-75	50-60	20-30	5-10
	8-13	Gravelly sandy loam, gravelly loam.	GM, GM-GC	A-1, A-2	5-30	55-65	50-60	30-50	15-30	15-25	NP-10
	13-60	Very gravelly sand, very cobbly sand, very gravelly coarse sandy loam.	GP-GM, GM	A-1	20-60	30-60	25-50	15-40	5-15	---	NP
Yeates Hollow:											
YaA----------------	0-14	Loam-------------	CL-ML	A-4	0-5	75-90	75-85	70-80	50-60	25-30	5-10
	14-60	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30

See footnotes at end of table.

TABLE 12.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Yeates Hollow:											
YbC----------------	0-12	Cobbly loam-----	CL-ML	A-4	25-45	75-90	75-85	70-80	50-60	25-30	5-10
	12-43	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30
	43	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
YcD----------------	0-19	Very stony loam	GM-GC, GC, CL-ML, CL	A-4, A-6	45-75	65-85	65-80	55-75	45-70	25-40	5-15
	19-55	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[1]YdG:											
Yeates Hollow part------------	0-13	Very stony loam	GM-GC, GC, CL-ML, CL	A-4, A-6	45-75	65-85	65-80	55-75	45-70	25-40	5-15
	13-42	Very cobbly clay, very cobbly clay loam.	GC	A-7, A-2	45-75	40-55	35-55	25-50	20-45	40-60	15-30
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Smarts part------	0-20	Loam------------	CL-ML, ML	A-4	0-5	90-100	80-100	75-90	60-75	25-35	5-10
	20-44	Very cobbly loam, very gravelly clay loam, gravelly clay loam.	GM-GC, GC	A-2, A-4, A-6	10-40	50-70	40-60	35-45	30-40	25-40	5-15
	44	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Yeljack:											
YeD, YeE-----------	0-22	Loam------------	CL-ML	A-4	0	95-100	90-100	75-95	55-75	20-30	5-10
	22-34	Loam, very fine sandy loam.	CL-ML, SM-SC	A-4	0	85-100	80-100	65-95	45-75	20-30	5-10
	34-60	Clay loam, sandy clay loam, cobbly clay loam.	CL-ML, CL, SC-SM, SC	A-4, A-6	0-25	85-100	80-100	70-100	35-80	30-40	5-15

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Agassiz:											
[1]AaG:											
Agassiz part----	0-8	0.6-2.0	0.10-0.14	6.1-8.4	<2	Low-------	High-----	Moderate	0.17	1	8
	8-14	2.0-0.6	0.07-0.10	6.1-8.4	<2	Low-------	High-----	Moderate	0.15		
	14	---	---	---	---	---------	---------	---------	---		
Rock outcrop part.											
[1]AbG:											
Agassiz part----	0-10	0.6-2.0	0.09-0.13	6.6-8.4	<2	Low-------	High-----	Moderate	0.20	1	8
	10	---	---	---	---	---------	---------	---------	---		
Rock outcrop part.											
[1]AGG:											
Agassiz part----	0-8	0.6-2.0	0.10-0.14	6.1-8.4	<2	Low-------	High-----	Moderate	0.17	1	8
	8-14	0.2-0.6	0.07-0.10	6.1-8.4	<2	Low-------	High-----	Moderate	0.15		
	14	---	---	---	---	---------	---------	---------	---		
Geertsen part---	0-10	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low-------	High-----	Low------	0.24	1	6
	10-45	0.2-0.6	0.07-0.10	6.1-7.3	<2	Low-------	High-----	Low------	0.20		
	45	---	---	---	---	---------	---------	---------	---		
Rock outcrop part.											
Ant Flat:											
AnD--------------	0-10	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	High-----	Moderate	0.24	3	6
	10-26	0.06-0.2	0.14-0.20	6.1-8.4	<2	High------	High-----	Moderate	0.32		
	26-60	0.06-0.6	0.14-0.20	6.6-9.0	<2	Moderate	High-----	Moderate	0.43		
Bertag:											
BAF, BbG---------	0-24	0.6-2.0	0.15-0.18	6.1-6.5	<2	Low-------	High-----	Low------	0.28	5	6
	24-60	0.06-0.2	0.13-0.18	5.6-6.5	<2	High------	High-----	Moderate	0.32		
BcE--------------	0-25	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low-------	High-----	Low------	0.24	5	8
	25-60	0.06-0.2	0.13-0.18	5.6-6.5	<2	High------	High-----	Moderate	0.32		
Broad Canyon:											
BdG--------------	0-15	0.6-2.0	0.09-0.12	5.6-6.5	<2	Low-------	High-----	Moderate	0.17	2	8
	15-60	2.0-6.0	0.05-0.07	5.6-6.5	<2	Low-------	High-----	Moderate	0.15		
Broadhead:											
BeB--------------	0-17	0.2-2.0	0.17-0.19	7.4-7.8	<2	Moderate	High-----	Moderate	0.20	2	6
	17-43	0.06-0.2	0.17-0.20	6.6-7.3	<2	High------	High-----	Moderate	0.20		
	43-60	0.06-0.6	0.17-0.19	6.6-8.4	<2	Moderate	High-----	Moderate	0.49		
Brownlee:											
BfA, BfB---------	0-10	0.6-2.0	0.14-0.16	6.1-6.5	<2	Low-------	Moderate	Moderate	0.24	5	6
	10-46	0.2-0.6	0.14-0.18	5.6-6.5	<2	Moderate	High-----	Moderate	0.32		
	46-63	0.6-2.0	0.09-0.15	5.6-6.5	<2	Low-------	High-----	Moderate	0.43		
Bullnel:											
BnC2, BnG--------	0-6	0.6-2.0	0.12-0.15	6.1-7.8	<2	Low-------	High-----	Low------	0.20	2	8
	6-25	0.2-0.6	0.12-0.15	6.1-8.4	<2	Low-------	High-----	Low------	0.37		
	25	---	---	---	---	---------	---------	---------	---		
Burgi:											
BuG--------------	0-20	0.6-2.0	0.15-0.17	6.1-7.3	<2	Low-------	Moderate	Low------	0.28	3	5
	20-60	2.0-6.0	0.07-0.10	6.6-8.4	<2	Low-------	High-----	Low------	0.15		
Caballo:											
CaG--------------	0-10	0.6-2.0	0.08-0.13	6.6-7.3	<2	Low-------	High-----	Low------	0.20	3	8
	10-53	0.6-2.0	0.07-0.09	6.6-8.4	<2	Low-------	High-----	Low------	0.17		
	53	---	---	---	---	---------	---------	---------	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodi-bility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Canburn:											
Cb----------------	0-21	0.2-0.6	0.17-0.20	7.4-9.0	<2	Moderate	High-----	Moderate	0.24	5	8
	21-60	0.2-0.6	0.13-0.18	7.4-9.0	<2	Moderate	High-----	Moderate	0.32		
Causey:											
CdG---------------	0-19	0.6-2.0	0.17-0.18	6.1-7.3	<2	Low-------	High-----	Low------	0.32	4	5
	19-40	0.6-2.0	0.15-0.17	7.4-7.8	<2	Low-------	High-----	Low------	0.43		
	40-63	0.6-2.0	0.06-0.10	7.4-7.8	<2	Low-------	High-----	Low------	0.37		
[1]CeG:											
Causey part-----	0-19	0.6-2.0	0.17-0.18	6.1-7.3	<2	Low-------	High-----	Low------	0.32	4	5
	19-40	0.6-2.0	0.15-0.17	7.4-7.8	<2	Low-------	High-----	Low------	0.43		
	40-63	0.6-2.0	0.06-0.10	7.4-7.8	<2	Low-------	High-----	Low------	0.37		
Choptie part----	0-14	0.6-2.0	0.13-0.20	6.1-7.3	<2	Low-------	High-----	Moderate	0.28	1	5
	14	---	---	---	---	----------	---------	---------	---		
Charcol:											
ChG---------------	0-21	0.6-2.0	0.08-0.10	5.6-7.3	<2	Low-------	High-----	Moderate	0.15	2	8
	21-62	0.6-2.0	0.06-0.08	5.6-6.5	<2	Low-------	High-----	Moderate	0.24		
Cloud Rim:											
CnG---------------	0-15	0.6-2.0	0.17-0.19	6.1-7.3	<2	Moderate	Moderate	Low------	0.28	5	5
	15-56	0.6-2.0	0.10-0.15	6.1-7.3	<2	Low-------	Moderate	Low------	0.37		
	56-66	0.6-2.0	0.08-0.13	6.1-7.3	<2	Low-------	Moderate	Low------	0.20		
Condie:											
CoG---------------	0-25	0.6-2.0	0.09-0.14	5.6-7.3	<2	Low-------	High-----	Moderate	0.15	2	8
	25-42	0.2-0.6	0.06-0.12	5.6-6.5	<2	Low-------	High-----	Moderate	0.28		
	42-66	0.6-6.0	0.06-0.08	6.6-7.3	<2	Low-------	High-----	Moderate	0.24		
Cristo:											
[1]CrG:											
Cristo part-----	0-13	0.6-2.0	0.15-0.17	6.1-6.5	<2	Low-------	High-----	Low------	0.24	3	6
	13-21	0.2-0.6	0.14-0.18	6.1-6.5	<2	Moderate	High-----	Low------	0.37		
	21-35	0.6-2.0	0.08-0.10	6.1-7.8	<2	Low-------	High-----	Low------	0.15		
	35	---	---	---	---	----------	---------	---------	---		
Wallsburg part--	0-10	0.6-2.0	0.10-0.14	6.6-7.3	<2	Low-------	High-----	Moderate	0.15	1	8
	10-15	0.2-0.6	0.05-0.10	6.6-7.3	<2	Low-------	High-----	Moderate	0.15		
	15	---	---	---	---	----------	---------	---------	---		
Crooked Creek:											
Ct----------------	0-14	0.06-0.2	0.18-0.20	6.1-8.4	<4	High------	High-----	Low------	0.28	4	6
	14-52	0.06-0.2	0.18-0.20	6.1-8.4	<2	High------	High-----	Low------	0.24		
	52-60	0.2-0.6	0.11-0.16	6.1-8.4	<2	Low-------	High-----	Low------	0.28		
Croydon:											
CvG---------------	0-22	0.6-2.0	0.13-0.18	5.6-7.3	<2	Moderate	High-----	Moderate	0.24	3	5
	22-48	0.2-0.6	0.13-0.18	5.6-7.3	<2	Moderate	High-----	Moderate	0.32		
	48	---	---	---	---	----------	---------	---------	---		
Cumulic Haploborolls:											
CW----------------	0-60	---	---	---	---	----------	---------	---------	---	---	---
Cumulic Haploxerolls:											
CX----------------	0-60	---	---	---	---	----------	---------	---------	---	---	---
Donner:											
DaG---------------	0-6	0.6-2.0	0.10-0.15	5.6-6.5	<2	Low-------	High-----	Moderate	0.24	1	8
	6-34	0.06-0.2	0.14-0.18	5.6-6.5	<2	Moderate	High-----	Moderate	0.32		
	34	---	---	---	---	----------	---------	---------	---		
[1]DbE:											
Donner part-----	0-6	0.6-2.0	0.10-0.15	5.6-6.5	<2	Low-------	High-----	Moderate	0.24	1	8
	6-36	0.06-0.2	0.14-0.18	5.6-6.5	<2	Moderate	High-----	Moderate	0.32		
	36	---	---	---	---	----------	---------	---------	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi-bility group
	In	In/hr	In/in	pH	Mmhos/cm						
Donner:											
[1]DbE:											
Bertag part-----	0-12	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low--------	High-----	Low------	0.24	5	8
	12-60	0.06-0.2	0.13-0.18	5.6-6.5	<2	High------	High-----	Moderate	0.32		
Durfee:											
DeG---------------	0-6	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low--------	High-----	Moderate	0.20	2	8
	6-16	0.6-2.0	0.08-0.10	6.1-7.3	<2	Low--------	High-----	Moderate	0.17		
	16-60	0.06-0.2	0.08-0.10	5.6-7.3	<2	Moderate	High-----	Moderate	0.10		
[1]DmG:											
Durfee part-----	0-6	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low--------	High-----	Moderate	0.20	2	8
	6-16	0.6-2.0	0.08-0.10	6.1-7.3	<2	Low--------	High-----	Moderate	0.17		
	16-60	0.06-0.2	0.08-0.10	5.6-7.3	<2	Moderate	High-----	Moderate	0.10		
Moweba part-----	0-31	0.6-2.0	0.10-0.13	5.6-7.3	<2	Low--------	High-----	Moderate	0.20	3	8
	31-72	2.0-6.0	0.06-0.10	5.6-7.3	<2	Low--------	High-----	Moderate	0.24		
Durst:											
DuG---------------	0-10	0.6-2.0	0.09-0.13	5.1-6.0	<2	Low--------	High-----	Moderate	0.20	1	8
	10-25	0.2-0.6	0.05-0.11	5.1-6.0	<2	Low--------	High-----	Moderate	0.24		
	25	---	---	---	---	----------	---------	---------	---		
Eastcan:											
EaA, EcA----------	0-13	0.6-2.0	0.16-0.20	7.4-9.0	<2	Moderate	High-----	Low------	0.20	5	6
	13-60	0.6-2.0	0.16-0.20	7.4-9.0	<2	Moderate	High-----	Low------	0.28		
Eastcan variant:											
EdC, EeC----------	0-9	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low--------	High-----	Low------	0.24	5	6
	9-60	0.2-0.6	0.11-0.15	7.4-8.4	<2	Low--------	High-----	Low------	0.20		
Ercan:											
ErD, ErE, ErG-----	0-18	0.6-2.0	0.15-0.17	6.1-6.5	<2	Moderate	High-----	Moderate	0.24	4	6
	18-27	0.6-2.0	0.07-0.17	5.6-6.5	<2	Moderate	High-----	Moderate	0.32		
	27-56	0.2-0.6	0.10-0.17	5.6-6.5	<2	Moderate	High-----	Moderate	0.37		
	56	---	---	---	---	----------	---------	---------	---		
Etchen:											
EtG---------------	0-8	0.6-2.0	0.06-0.10	6.6-8.4	<2	Low--------	High-----	Low------	0.20	2	8
	8-34	0.2-2.0	0.05-0.08	6.6-8.4	<2	Low--------	High-----	Low------	0.17		
	34	---	---	---	---	----------	---------	---------	---		
[1]EVG:											
Etchen part-----	0-4	0.6-2.0	0.06-0.10	6.6-8.4	<2	Low--------	High-----	Low------	0.20	2	8
	4-21	0.2-2.0	0.05-0.08	6.6-8.4	<2	Low--------	High-----	Low------	0.17		
	21	---	---	---	---	----------	---------	---------	---		
Henhoit part----	0-10	0.6-2.0	0.10-0.13	5.6-6.5	<2	Low--------	High-----	Moderate	0.17	3	8
	10-60	0.2-0.6	0.09-0.12	5.6-6.5	<2	Moderate	High-----	Moderate	0.28		
[1]EXG:											
Etchen part-----	0-11	0.6-2.0	0.06-0.10	6.6-8.4	<2	Low--------	High-----	Low------	0.20	2	8
	11-26	0.2-2.0	0.05-0.08	6.6-8.4	<2	Low--------	High-----	Low------	0.17		
	26	---	---	---	---	----------	---------	---------	---		
Schuster part---	0-16	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	High-----	Moderate	0.15	2	8
	16-25	0.6-2.0	0.11-0.13	5.6-6.5	<2	Low--------	High-----	Moderate	0.32		
	25-60	0.2-0.6	0.06-0.12	5.6-6.5	<2	Moderate	High-----	Moderate	0.28		
Fluvaquentic Haploborolls:											
[1]FAB:											
Fluvaquentic Haploborolls part-----------	0-60	---	---	---	---	----------	---------	---------	---	---	---
Fluventic Haploxerolls part-----------	0-60	---	---	---	---	----------	---------	---------	---	---	---

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm						
Flygare:											
FcG---------------	0-20	0.6-2.0	0.17-0.19	5.6-6.5	<2	Low--------	High-----	Moderate	0.28	2	6
	20-36	0.6-2.0	0.04-0.08	5.6-6.5	<2	Low--------	High-----	Moderate	0.28		
	36-60	0.6-2.0	0.06-0.08	5.1-6.5	<2	Low--------	High-----	Moderate	0.24		
Foxol:											
[1]FdG:											
Foxol part------	0-10	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	Moderate	Moderate	0.17	1	8
	10-16	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	Moderate	Moderate	0.17		
	16	---	---	---	---	----------	---------	---------	---		
Durfee part-----	0-6	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low--------	High-----	Moderate	0.20	2	8
	6-16	0.6-2.0	0.08-0.10	6.1-7.3	<2	Low--------	High-----	Moderate	0.17		
	16-60	0.06-0.2	0.08-0.10	5.6-7.3	<2	Moderate	High-----	Moderate	0.10		
[1]FrG:											
Foxol part------	0-9	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	Moderate	Moderate	0.17	1	8
	9-14	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	Moderate	Moderate	0.17		
	14	---	---	---	---	----------	---------	---------	---		
Rock outcrop part.											
Geertsen:											
GaG---------------	0-8	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low--------	High-----	Low-------	0.24	1	6
	8-45	0.2-0.6	0.07-0.10	6.1-7.3	<2	Low--------	High-----	Low-------	0.20		
	45	---	---	---	---	----------	---------	---------	---		
[1]GcG:											
Geertsen part---	0-10	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low--------	High-----	Low-------	0.24	1	6
	10-48	0.2-0.6	0.07-0.10	6.1-7.3	<2	Low--------	High-----	Low-------	0.20		
	48	---	---	---	---	----------	---------	---------	---		
Agassiz part----	0-8	0.6-2.0	0.10-0.14	6.1-8.4	<2	Low--------	High-----	Moderate	0.17	1	8
	8-14	0.2-0.6	0.07-0.10	6.1-8.4	<2	Low--------	High-----	Moderate	0.15		
	14	---	---	---	---	----------	---------	---------	---		
Guilder:											
GeE---------------	0-12	0.6-2.0	0.15-0.18	6.1-7.3	<2	Low--------	High-----	Low-------	0.24	5	6
	12-31	0.06-0.2	0.17-0.18	6.1-8.4	<2	Moderate	High-----	Low-------	0.32		
	31-65	0.2-0.6	0.15-0.18	7.9-8.4	<2	Moderate	High-----	Low-------	0.43		
	65	---	---	---	---	----------	---------	---------	---		
Hades:											
HaC, HaG----------	0-38	0.6-2.0	0.15-0.18	5.6-7.3	<2	Low--------	High-----	Moderate	0.24	5	6
	38-62	0.2-0.6	0.15-0.18	5.6-8.4	<2	Moderate	High-----	Moderate	0.37		
Hawkins:											
HbC, HbD, HbE-----	0-37	0.06-0.2	0.16-0.18	5.6-7.8	<2	High------	High-----	Moderate	0.20	5	4
	37-60	0.06-0.2	0.15-0.18	6.6-9.0	<2	High------	High-----	Low-------	0.28		
[1]HcE:											
Hawkins part----	0-48	0.06-0.2	0.16-0.18	5.6-7.8	<2	High------	High-----	Moderate	0.20	5	4
	48-60	0.06-0.2	0.15-0.18	6.6-9.0	<2	High------	High-----	Low-------	0.28		
Collinston part-	0-9	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	High-----	Moderate	0.28	5	4L
	9-60	0.6-2.0	0.17-0.19	>7.4	<2	Moderate	High-----	Moderate	0.32		
Henefer:											
HeD, HeG----------	0-15	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	High-----	Low-------	0.37	2	5
	15-60	0.06-0.2	0.13-0.15	5.6-7.3	<2	High------	High-----	Moderate	0.24		
Henhoit:											
HpG---------------	0-10	0.6-2.0	0.10-0.13	5.6-7.3	<2	Low--------	High-----	Moderate	0.17	3	8
	10-60	0.2-0.6	0.09-0.12	5.6-7.3	<2	Moderate	High-----	Moderate	0.28		
Herd:											
HrC---------------	0-17	0.2-2.0	0.09-0.14	5.6-6.5	<2	Low--------	High-----	Moderate	0.24	5	8
	17-43	0.06-0.2	0.16-0.18	5.6-6.5	<2	High------	High-----	Moderate	0.28		
	43	---	---	---	---	----------	---------	---------	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm						
Herd:											
[1]HtC:											
Herd part	0-20	0.2-2.0	0.09-0.14	5.6-6.5	<2	Low	High	Moderate	0.24	5	8
	20-36	0.06-0.2	0.16-0.18	5.1-6.5	<2	High	High	Moderate	0.28		
	36-60	0.2-0.6	0.15-0.17	5.1-6.5	<2	Moderate	High	Moderate	0.32		
Yence part	0-9	0.6-2.0	0.08-0.13	6.1-7.3	<2	Low	High	Low	0.15	1	8
	9-42	0.06-0.2	0.07-0.11	5.6-7.3	<2	Moderate	High	Moderate	0.20		
	42	---	---	---	---	---	---	---	---		
Holmes:											
HuC	0-11	0.6-2.0	0.05-0.08	5.6-6.5	<2	Low	High	Moderate	0.24	1	8
	11-60	0.6-2.0	0.06-0.09	5.6-6.5	<2	Low	High	Moderate	0.24		
Horrocks:											
[1]HvG:											
Horrocks part	0-15	0.6-2.0	0.11-0.13	5.1-6.5	<2	Low	High	Moderate	0.17	1	8
	15-45	0.6-2.0	0.07-0.09	6.1-7.8	<2	Low	High	Moderate	0.24		
	45	---	---	---	---	---	---	---	---		
Rock outcrop part.											
Hoskin:											
HwG	0-19	0.6-2.0	0.11-0.13	6.1-7.8	<2	Low	High	Low	0.32	1	8
	19-39	0.6-2.0	0.07-0.10	6.1-7.8	<2	Low	High	Low	0.24		
	39	---	---	---	---	---	---	---	---		
[1]HxG:											
Hoskin part	0-14	0.6-2.0	0.11-0.13	6.1-7.8	<2	Low	High	Low	0.32	1	8
	14-39	0.6-2.0	0.07-0.10	6.1-7.8	<2	Low	High	Low	0.24		
	39	---	---	---	---	---	---	---	---		
Rock outcrop part.											
Isbell:											
IbG	0-8	0.6-2.0	0.14-0.17	6.1-7.3	<2	Low	High	Low	0.24	4	6
	8-25	0.2-0.6	0.15-0.18	6.1-7.3	<2	Moderate	High	Low	0.24		
	25-60	0.2-0.6	0.15-0.18	6.1-9.0	<2	Moderate	High	Low	0.24		
IgD	0-17	0.6-2.0	0.13-0.17	6.1-6.5	<2	Low	High	Low	0.20	4	5
	17-50	0.2-0.6	0.14-0.17	6.1-6.5	<2	Moderate	High	Low	0.32		
	50-60	2.0-6.0	0.05-0.11	6.1-7.8	<2	Low	High	Low	0.32		
Kahler:											
KaB, KaC	0-28	0.6-2.0	0.13-0.20	6.1-7.3	<2	Low	Moderate	Low	0.37	3	---
	28-73	0.6-2.0	0.13-0.20	6.1-7.3	<2	Low	Moderate	Low	0.43		
Kilfoil:											
KfF	0-3	0.6-2.0	0.14-0.18	6.6-9.0	<2	Low	High	Low	0.17	2	6
	3-19	0.2-2.0	0.15-0.18	7.4-9.0	<2	Moderate	High	Low	0.28		
	19-37	0.6-2.0	0.08-0.13	6.6-9.0	<2	Low	High	Low	0.32		
	37	---	---	---	---	---	---	---	---		
[1]KrG:											
Kilfoil part	0-3	0.6-2.0	0.14-0.18	6.6-9.0	<2	Low	High	Low	0.17	2	6
	3-21	0.2-2.0	0.15-0.18	7.4-9.0	<2	Moderate	High	Low	0.28		
	21-30	0.6-2.0	0.08-0.13	6.6-9.0	<2	Low	High	Low	0.32		
	30	---	---	---	---	---	---	---	---		
Rock outcrop part.											
Lamondi:											
LaD, LaE	0-21	0.6-2.0	0.08-0.13	6.1-6.5	<2	Low	High	Low	0.20	3	8
	21-61	0.6-2.0	0.06-0.10	5.6-6.5	<2	Low	High	Moderate	0.28		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Lithic Haploxerolls:											
[1]LHG:											
Lithic Haploxerolls part	0-14	---	---	---	---	---	---	---	---	---	---
Rock outcrop part.											
Lucky Star:											
LkD, LkG	0-20	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	High	Moderate	0.32	2	5
	20-60	0.6-6.0	0.05-0.09	5.6-7.3	<2	Low	High	Moderate	0.28		
[1]LmG:											
Lucky Star part	0-19	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	High	Moderate	0.32	2	5
	19-74	0.6-6.0	0.05-0.09	5.6-7.3	<2	Low	High	Moderate	0.28		
Charcol part	0-27	0.6-2.0	0.08-0.10	5.6-7.3	<2	Low	High	Moderate	0.15	2	8
	27-72	0.6-2.0	0.06-0.08	5.6-6.5	<2	Low	High	Moderate	0.24		
[1]LNG:											
Lucky Star part	0-19	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	High	Moderate	0.32	2	5
	19-74	0.6-6.0	0.05-0.09	5.6-7.3	<2	Low	High	Moderate	0.28		
Ercan part	0-31	0.6-2.0	0.15-0.17	6.1-6.5	<2	Moderate	High	Moderate	0.24	4	6
	31-39	0.6-2.0	0.07-0.17	5.6-6.5	<2	Moderate	High	Moderate	0.32		
	39-60	0.2-0.6	0.10-0.17	5.6-6.5	<2	Moderate	High	Moderate	0.37		
Manila:											
MbA, MbB, MbC, MbD, MbE	0-17	0.6-2.0	0.16-0.18	6.1-8.4	<2	Moderate	High	Low	0.43	2	6
	17-60	0.06-0.2	0.17-0.19	5.6-7.3	<2	High	High	Moderate	0.37		
[1]McD:											
Manila part	0-11	0.6-2.0	0.16-0.18	6.1-8.4	<2	Moderate	High	Low	0.43	2	6
	11-50	0.06-0.2	0.17-0.19	5.6-7.3	<2	High	High	Moderate	0.37		
	50-62	0.2-0.6	0.10-0.18	6.1-8.4	<2	Moderate	High	Low	0.43		
Yeates Hollow part	0-13	0.6-2.0	0.06-0.08	5.6-7.3	<2	Low	High	Moderate	0.17	1	8
	13-42	0.06-0.2	0.07-0.10	5.1-7.3	<2	Low	High	Moderate	0.17		
	42	---	---	---	---	---	---	---	---		
[1]McG:											
Manila part	0-17	0.6-2.0	0.16-0.18	6.1-8.4	<2	Moderate	High	Low	0.43	2	6
	17-60	0.06-0.2	0.17-0.19	5.6-7.3	<2	High	High	Moderate	0.37		
Yeates Hollow part	0-13	0.6-2.0	0.06-0.08	5.6-7.3	<2	Low	High	Moderate	0.17	1	8
	13-42	0.06-0.2	0.07-0.10	5.1-7.3	<2	Low	High	Moderate	0.17		
	42	---	---	---	---	---	---	---	---		
Mondey:											
MeD, MeE	0-9	0.2-0.6	0.16-0.18	6.1-7.3	<2	Moderate	High	Low	0.20	5	6
	9-31	0.06-0.2	0.16-0.18	6.1-7.3	<2	High	High	Low	0.32		
	31-60	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate	High	Low	0.32		
Morgala:											
MoG	0-4	0.2-0.6	0.15-0.18	6.6-7.8	<2	Moderate	High	Low	0.24	5	6
	4-39	0.06-0.2	0.15-0.18	6.6-8.4	<2	Moderate	High	Low	0.32		
	39-60	0.06-0.2	0.13-0.18	7.9-9.0	<2	Moderate	High	Low	0.32		
[1]MrG:											
Morgala part	0-15	0.2-0.6	0.15-0.18	6.6-7.8	<2	Moderate	High	Low	0.24	5	6
	15-60	0.06-0.2	0.15-0.18	6.6-8.4	<2	Moderate	High	Low	0.32		
Rock outcrop part.											

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Moweba:											
MwC, MwG	0-24	0.6-2.0	0.10-0.13	5.6-7.3	<2	Low	High	Moderate	0.20	3	8
	24-60	2.0-6.0	0.06-0.10	5.6-7.3	<2	Low	High	Moderate	0.24		
[1]MyG:											
Moweba part	0-30	0.6-2.0	0.10-0.13	5.6-7.3	<2	Low	High	Moderate	0.20	3	8
	30-65	2.0-6.0	0.06-0.10	5.6-7.3	<2	Low	High	Moderate	0.24		
St. Marys part	0-14	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low	High	Low	0.24	1	8
	14-60	0.6-6.0	0.05-0.08	6.1-7.8	<2	Low	High	Low	0.17		
Nagitsy:											
NAE	0-23	0.6-2.0	0.07-0.09	5.6-7.3	<2	Low	Moderate	Low	0.15	2	5
	23	---	---	---	---	---	---	---	---		
[1]NcG:											
Nagitsy part	0-15	0.6-2.0	0.10-0.12	5.6-6.5	<2	Low	High	Moderate	0.17	2	8
	15-39	0.6-2.0	0.08-0.10	5.6-6.0	<2	Low	High	Moderate	0.17		
	39	---	---	---	---	---	---	---	---		
Rock outcrop part.											
[1]NDG:											
Nagitsy part	0-8	0.6-2.0	0.10-0.12	5.6-6.5	<2	Low	High	Moderate	0.17	2	8
	8-28	0.6-2.0	0.08-0.10	5.6-6.0	<2	Low	High	Moderate	0.17		
	28	---	---	---	---	---	---	---	---		
Broad Canyon part	0-14	0.6-2.0	0.09-0.12	5.6-6.5	<2	Low	High	Moderate	0.17	2	8
	14-60	2.0-6.0	0.05-0.07	5.6-6.5	<2	Low	High	Moderate	0.15		
Rock outcrop part.											
[1]NPG:											
Nagitsy part	0-15	0.6-2.0	0.10-0.12	5.6-6.5	<2	Low	High	Moderate	0.17	2	8
	15-39	0.6-2.0	0.08-0.10	5.6-6.0	<2	Low	High	Moderate	0.17		
	39	---	---	---	---	---	---	---	---		
Patio part	0-13	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low	High	Low	0.15	2	8
	13-26	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low	High	Moderate	0.20		
	26	---	---	---	---	---	---	---	---		
Rock outcrop part.											
Nebeker:											
NrA, NrB	0-20	0.2-2.0	0.16-0.18	6.1-7.3	<2	Moderate	High	Low	0.37	3	6
	20-60	0.06-0.2	0.17-0.19	6.1-7.3	<2	High	High	Low	0.24		
Nicodemus:											
NsA	0-8	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low	High	Moderate	0.15	3	8
	8-22	0.6-2.0	0.11-0.13	6.1-7.3	<2	Low	High	Moderate	0.15		
	22-60	2.0-20	0.03-0.05	5.6-6.5	<2	Low	High	Moderate	0.10		
Norcan:											
NtG	0-15	0.2-0.6	0.16-0.18	6.1-7.3	<2	Moderate	High	Low	0.24	2	6
	15-60	0.06-0.2	0.16-0.18	6.1-7.3	<2	High	High	Low	0.32		
Nordic:											
NuG	0-15	0.6-2.0	0.12-0.15	6.1-6.5	<2	Low	High	Low	0.20	4	8
	15-40	0.6-2.0	0.09-0.12	6.1-6.5	<2	Low	High	Low	0.24		
	40-70	0.2-0.6	0.07-0.10	5.6-6.5	<2	Low	High	Moderate	0.20		
[1]NVG:											
Nordic part	0-15	0.6-2.0	0.12-0.15	6.1-6.5	<2	Low	High	Low	0.20	4	8
	15-40	0.6-2.0	0.09-0.12	6.1-6.5	<2	Low	High	Low	0.24		
	40-70	0.2-0.6	0.07-0.10	5.6-6.5	<2	Low	High	Moderate	0.20		
Patio part	0-16	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low	High	Low	0.15	2	8
	16-35	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low	High	Moderate	0.20		
	35	---	---	---	---	---	---	---	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm						
Ostler:											
OaG---------------	0-18	0.2-0.6	0.16-0.18	6.1-7.3	<2	Moderate	High-----	Low------	0.28	5	6
	18-60	0.06-0.2	0.16-0.18	5.6-7.3	<2	High------	High-----	Moderate	0.28		
[1]OcG:											
Ostler part-----	0-10	0.2-0.6	0.16-0.18	6.1-7.3	<2	Moderate	High-----	Low------	0.28	5	6
	10-48	0.06-0.2	0.16-0.18	5.6-7.3	<2	High------	High-----	Moderate	0.28		
	48	---	---	---	---	---------	---------	---------	---		
Causey part-----	0-19	0.6-2.0	0.17-0.18	6.1-7.3	<2	Low--------	High-----	Low------	0.32	4	5
	19-40	0.6-2.0	0.15-0.17	7.4-7.8	<2	Low--------	High-----	Low------	0.43		
	40-63	0.6-2.0	0.06-0.10	7.4-7.8	<2	Low--------	High-----	Low------	0.37		
[1]ODG:											
Ostler part-----	0-18	0.2-0.6	0.16-0.18	6.1-7.3	<2	Moderate	High-----	Low------	0.28	5	6
	18-60	0.06-0.2	0.16-0.18	5.6-7.3	<2	High------	High-----	Moderate	0.28		
Bertag part-----	0-18	0.6-2.0	0.15-0.18	6.1-6.5	<2	Low--------	High-----	Low------	0.28	5	6
	18-60	0.06-0.2	0.13-0.18	5.6-6.5	<2	High------	High-----	Moderate	0.32		
Parleys:											
PaA---------------	0-13	0.6-2.0	0.16-0.18	6.1-8.4	<2	Moderate	High-----	Low------	0.32	3	6
	13-32	0.2-0.6	0.16-0.18	6.1-8.4	<2	Moderate	High-----	Low------	0.32		
	32-66	0.2-2.0	0.14-0.18	7.9-8.4	<2	Moderate	High-----	Low------	0.49		
Parlo:											
PcA---------------	0-19	0.6-2.0	0.16-0.18	6.6-7.8	<2	Moderate	High-----	Low------	0.37	3	6
	19-31	0.2-0.6	0.15-0.18	6.6-7.8	<2	Moderate	High-----	Low------	0.43		
	31-70	6.0-20	0.02-0.06	7.4-7.8	<2	Low--------	High-----	Low------	0.15		
Patio:											
PdG---------------	0-13	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low--------	High-----	Low------	0.15	2	8
	13-26	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	High-----	Moderate	0.20		
	26	---	---	---	---	---------	---------	---------	---		
Phoebe:											
PhA---------------	0-19	2.0-6.0	0.12-0.14	6.1-7.3	<2	Low--------	Moderate	Moderate	0.20	4	3
	19-46	6.0-20	0.08-0.12	6.1-7.3	<2	Low--------	Moderate	Moderate	0.24		
	46-60	>20	0.05-0.08	6.1-7.3	<2	Low--------	Moderate	Moderate	0.10		
Poleline:											
PoG---------------	0-24	0.6-2.0	0.08-0.10	5.6-7.3	<2	Low--------	High-----	Moderate	0.17	2	8
	24-48	0.6-6.0	0.05-0.09	5.6-8.4	<2	Low--------	High-----	Moderate	0.28		
	48	---	---	---	---	---------	---------	---------	---		
[1]PPG:											
Poleline part---	0-24	0.6-2.0	0.08-0.10	5.6-7.3	<2	Low--------	High-----	Moderate	0.17	2	8
	24-48	0.6-6.0	0.05-0.09	5.6-8.4	<2	Low--------	High-----	Moderate	0.28		
	48	---	---	---	---	---------	---------	---------	---		
Patio part------	0-13	0.6-2.0	0.10-0.13	6.1-7.3	<2	Low--------	High-----	Low------	0.15	2	8
	13-26	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low--------	High-----	Moderate	0.20		
	26	---	---	---	---	---------	---------	---------	---		
Pringle:											
PrA---------------	0-19	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	High-----	Moderate	0.24	2	5
	19-60	6.0-20	0.02-0.06	7.4-8.4	<2	Low--------	High-----	Moderate	0.10		
Redcan:											
[1]RaG:											
Redcan part-----	0-6	0.6-2.0	0.10-0.14	7.9-8.4	<2	Low--------	High-----	Low------	0.20	1	8
	6-15	0.6-2.0	0.08-0.12	7.9-8.4	<2	Low--------	High-----	Low------	0.15		
	15	---	---	---	---	---------	---------	---------	---		
Etchen part-----	0-8	0.6-2.0	0.06-0.10	6.6-8.4	<2	Low--------	High-----	Low------	0.20	2	8
	8-34	0.2-2.0	0.05-0.08	6.6-8.4	<2	Low--------	High-----	Low------	0.17		
	34	---	---	---	---	---------	---------	---------	---		
[1]RcG:											
Redcan part-----	0-5	0.6-2.0	0.10-0.14	7.9-8.4	<2	Low--------	High-----	Low------	0.20	1	8
	5-19	0.6-2.0	0.08-0.12	7.9-8.4	<2	Low--------	High-----	Low------	0.15		
	19	---	---	---	---	---------	---------	---------	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH	Mmhos/cm						
Redcan:											
[1]RcG:											
Rock outcrop part.											
Redola:											
ReA----------------	0-24	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low--------	High------	Low-------	0.32	5	4L
	24-60	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low--------	High------	Low-------	0.28		
Richens:											
RhC----------------	0-19	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low--------	High------	Low-------	0.20	4	6
	19-56	0.06-0.2	0.14-0.18	6.1-7.3	<2	High-------	High------	Low-------	0.32		
	56	---	---	---	---	---------	---------	---------	---		
Richville:											
RvG----------------	0-4	0.6-2.0	0.12-0.17	7.9-9.0	<2	Low--------	High------	Low-------	0.28	3	8
	4-28	0.2-0.6	0.13-0.17	7.9-9.0	<2	Low--------	High------	Low-------	0.43		
	28	---	---	---	---	---------	---------	---------	---		
Rock outcrop:											
RX.											
Scave:											
SaD, SaG-----------	0-14	0.6-2.0	0.13-0.15	5.6-6.5	<2	Low--------	High------	Moderate	0.32	1	6
	14-33	0.6-2.0	0.06-0.09	5.6-6.5	<2	Low--------	High------	Moderate	0.37		
	33-60	0.06-0.2	0.04-0.08	5.6-7.3	<2	Moderate	High------	Moderate	0.20		
Schuster:											
ScG----------------	0-18	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	High------	Moderate	0.15	2	8
	18-29	0.6-2.0	0.11-0.13	5.6-6.5	<2	Low--------	High------	Moderate	0.32		
	29-63	0.2-0.6	0.06-0.12	5.6-6.5	<2	Moderate	High------	Moderate	0.28		
Sessions:											
SeD----------------	0-11	0.6-2.0	0.10-0.14	6.6-7.3	<2	Low--------	High------	Low-------	0.20	2	8
	11-60	0.06-0.2	0.13-0.15	6.1-7.3	<2	Moderate	High------	Low-------	0.24		
Smarts:											
SfG----------------	0-26	0.6-2.0	0.14-0.18	5.1-7.3	<2	Low--------	High------	Low-------	0.32	3	6
	26-72	0.6-2.0	0.08-0.10	5.1-7.3	<2	Low--------	High------	Low-------	0.32		
SgG----------------	0-28	0.6-2.0	0.14-0.18	5.1-7.3	<2	Low--------	High------	Low-------	0.32	3	6
	28-41	0.6-2.0	0.08-0.10	5.1-7.3	<2	Low--------	High------	Low-------	0.32		
	41	---	---	---	---	---------	---------	---------	---		
Steed:											
SmA----------------	0-16	0.6-6.0	0.12-0.16	7.4-8.4	<2	Low--------	High------	Moderate	0.32	2	3
	16-60	6.0-20	0.02-0.05	7.4-8.4	<2	Low--------	High------	Moderate	0.10		
SnA----------------	0-13	0.6-6.0	0.08-0.12	7.4-8.4	<2	Low--------	High------	Moderate	0.28	2	8
	13-62	6.0-20	0.02-0.05	7.4-8.4	<2	Low--------	High------	Moderate	0.10		
St. Marys:											
SoG----------------	0-19	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low--------	High------	Low-------	0.24	1	8
	19-60	0.6-6.0	0.05-0.08	6.1-7.8	<2	Low--------	High------	Low-------	0.17		
SrG----------------	0-14	0.6-2.0	0.05-0.08	6.1-7.3	<2	Low--------	High------	Low-------	0.20	1	8
	14-44	0.6-6.0	0.05-0.08	6.1-7.8	<2	Low--------	High------	Low-------	0.17		
	44	---	---	---	---	---------	---------	---------	---		
[1]SsD:											
St. Marys part--	0-19	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low--------	High------	Low-------	0.24	1	8
	19-60	0.6-6.0	0.05-0.08	6.1-8.4	<2	Low--------	High------	Low-------	0.17		
Guilder part----	0-6	0.6-2.0	0.15-0.18	6.1-7.3	<2	Low--------	High------	Low-------	0.24	5	6
	6-27	0.06-0.2	0.17-0.18	6.1-8.4	<2	Moderate	High------	Low-------	0.32		
	27-60	0.2-0.6	0.15-0.18	7.9-8.4	<2	Moderate	High------	Low-------	0.43		
[1]StG:											
St. Marys part--	0-10	0.6-2.0	0.07-0.11	6.1-7.3	<2	Low--------	High------	Low-------	0.24	1	8
	10-60	0.6-6.0	0.05-0.08	6.1-7.8	<2	Low--------	High------	Low-------	0.17		
Hoskin part-----	0-7	0.6-2.0	0.11-0.13	6.1-7.8	<2	Low--------	High------	Low-------	0.32	1	8
	7-28	0.6-2.0	0.07-0.10	6.1-7.8	<2	Low--------	High------	Low-------	0.24		
	28	---	---	---	---	---------	---------	---------	---		

See footnotes at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Stoda:											
SuD, SuG	0-11	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	High	Low	0.28	4	6
	11-67	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low	High	Low	0.55		
Sunset:											
SwA	0-17	0.6-2.0	0.15-0.20	7.4-8.4	<4	Low	High	Moderate	0.43	3	4L
	17-45	0.6-2.0	0.10-0.15	7.4-8.4	<4	Low	High	Moderate	0.49		
	45-63	6.0-20	0.03-0.08	7.4-8.4	<4	Low	High	Moderate	0.10		
Toncana:											
TaG	0-24	0.6-2.0	0.13-0.17	5.6-6.5	<2	Low	High	Moderate	0.28	5	5
	24-60	0.2-0.6	0.08-0.11	5.6-6.0	<2	Low	High	Moderate	0.24		
Toone:											
TeG	0-27	0.6-2.0	0.14-0.17	6.1-7.3	<2	Moderate	High	Low	0.24	3	6
	27-60	0.2-0.6	0.09-0.12	6.1-7.3	<2	Moderate	High	Low	0.28		
Trojan:											
TnA, TnD	0-11	0.6-2.0	0.15-0.18	6.1-6.5	<2	Low	Moderate	Moderate	0.20	3	6
	11-50	0.6-2.0	0.11-0.16	6.1-6.5	<2	Moderate	Moderate	Moderate	0.28		
	50-60	0.6-2.0	0.04-0.10	6.1-6.5	<2	Low	Moderate	Moderate	0.17		
Utaba:											
UaA, UbA	0-8	0.6-2.0	0.09-0.12	6.1-7.8	<2	Low	High	Low	0.15	1	8
	8-29	0.6-6.0	0.06-0.10	6.1-7.8	<2	Low	High	Low	0.15		
	29-60	6.0-20.0	0.03-0.04	5.6-7.8	<2	Low	High	Moderate	0.10		
UcA	0-8	0.6-2.0	0.14-0.17	6.1-7.3	<2	Low	High	Low	0.20	1	5
	8-13	0.6-6.0	0.06-0.10	6.1-7.3	<2	Low	High	Low	0.15		
	13-60	6.0-20.0	0.03-0.04	5.6-7.8	<2	Low	High	Moderate	0.10		
Yeates Hollow:											
YaA	0-14	0.6-2.0	0.16-0.18	5.6-6.1	<2	Low	High	Moderate	0.24	1	6
	14-60	0.06-0.2	0.07-0.10	5.6-6.1	<2	Low	High	Moderate	0.17		
YbC	0-12	0.6-2.0	0.09-0.11	5.6-6.1	<2	Low	High	Moderate	0.20	1	8
	12-43	0.06-0.2	0.07-0.10	5.6-6.1	<2	Low	High	Moderate	0.17		
	43	---	---	---	---	---	---	---	---		
YcD	0-19	0.6-2.0	0.06-0.08	5.6-6.1	<2	Low	High	Moderate	0.17	1	8
	19-55	0.06-0.2	0.07-0.10	5.6-6.1	<2	Low	High	Moderate	0.17		
	55	---	---	---	---	---	---	---	---		
[1]YdG:											
Yeates Hollow part	0-13	0.6-2.0	0.06-0.08	5.6-6.1	<2	Low	High	Moderate	0.17	1	8
	13-42	0.06-0.2	0.07-0.10	5.6-6.1	<2	Low	High	Moderate	0.17		
	42	---	---	---	---	---	---	---	---		
Smarts part	0-20	0.6-2.0	0.14-0.18	5.6-6.1	<2	Low	High	Low	0.32	3	6
	20-44	0.6-2.0	0.08-0.10	5.6-6.1	<2	Low	High	Low	0.32		
	44	---	---	---	---	---	---	---	---		
Yeljack:											
YeD, YeE	0-22	0.6-2.0	0.15-0.17	5.6-7.3	<2	Low	High	Moderate	0.20	5	5
	22-34	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low	High	Low	0.37		
	34-60	0.2-0.6	0.14-0.18	5.6-8.4	<2	Moderate	High	Moderate	0.43		

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See Glossary for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Cemented pan: Depth	Cemented pan: Hardness	Potential frost action
					Ft			In		In		
Agassiz:												
[1]AaG, [1]AbG:												
Agassiz part	D	None	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate.
Rock outcrop part.												
[1]AGG:												
Agassiz part	D	None	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate.
Geertsen part	B	None	---	---	>6.0	---	---	>40	Rippable	---	---	Moderate.
Rock outcrop part.												
Ant Flat: AnD	C	None	---	---	>6.0	---	---	>40	---	---	---	Moderate.
Bertag: BAF, BbG, BcE	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Broad Canyon: BdG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Broadhead: BeB	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Brownlee: BfA, BfB	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Bullnel: BnC2, BnG	C	None	---	---	>6.0	---	---	21-40	Rippable	---	---	Moderate.
Burgi: BuG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Caballo: CaG	B	None	---	---	>6.0	---	---	40-60	Rippable	---	---	Moderate.
Canburn: Cb	D	Frequent	Long to very long.	Feb-May	0-1.5	Apparent	Feb-Jul	>60	---	---	---	High.
Causey: CdG	B	None	---	---	>6.0	---	---	>40	Rippable	---	---	Moderate.
[1]CeG:												
Causey part	B	None	---	---	>6.0	---	---	>40	Rippable	---	---	Moderate.
Choptie part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---	Moderate.
Charcol: ChG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Cloud Rim: CnG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Condie: CoG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	
					Ft			In		In		
Cristo:												
[1]CrG:												
Cristo part----	C	None--------	---	---	>6.0	---	---	29-36	Rip-pable	---	---	Moderate.
Wallsburg part-	D	None--------	---	---	>6.0	---	---	12-20	Hard	---	---	Moderate.
Crooked Creek:												
Ct--------------	D	Occasional	Brief-----	Mar-Jun	0-2.0	Apparent	Jan-Dec	>60	---	---	---	High.
Croydon:												
CvG-------------	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Cumulic Haploborolls:												
CW--------------	C	Frequent----	Very long	Feb-Jun	1.0-3.0	Apparent	Feb-Jun	>60	---	---	---	High.
Cumulic Haploxerolls:												
CX--------------	B	Occasional	Brief-----	Apr-Aug	>6.0	---	---	>60	---	---	---	Moderate.
Donner:												
DaG-------------	C	None--------	---	---	>6.0	---	---	23-40	Rip-pable	---	---	Moderate.
[1]DbE:												
Donner part----	C	None--------	---	---	>6.0	---	---	23-40	Rip-pable	---	---	Moderate.
Bertag part----	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Durfee:												
DeG-------------	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]DmG:												
Durfee part----	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Moweba part----	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Durst:												
DuG-------------	C	None--------	---	---	>6.0	---	---	20-32	Hard	---	---	Moderate.
Eastcan:												
EaA, EcA---------	B	Rare--------	---	---	3.0-5.0	Apparent	Apr-May	>60	---	---	---	High.
Eastcan variant:												
EdC, EeC---------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Ercan:												
ErD, ErE, ErG----	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Etchen:												
EtG-------------	C	None--------	---	---	>6.0	---	---	21-40	Hard	---	---	Moderate.
[1]EVG:												
Etchen part----	C	None--------	---	---	>6.0	---	---	21-40	Hard	---	---	Moderate.
Henhoit part---	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]EXG:												
Etchen part----	C	None--------	---	---	>6.0	---	---	21-40	Hard	---	---	Moderate.
Schuster part--	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Fluvaquentic Haploborolls:												
[1]FAB:												
Fluvaquentic Haploborolls part----------	C	Frequent----	Long------	Apr-Jun	1.5-3.5	Apparent	Apr-Jun	>60	---	---	---	Low.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Cemented pan: Depth	Cemented pan: Hardness	Potential frost action
					Ft			In		In		
Fluvaquentic Haploborolls:												
[1]FAB:												
Fluventic Haploxerolls part----------	B	------------	Brief-----	Feb-Jun	>6.0	---	---	>60	---	---	---	---
Flygare:												
FcG--------------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Foxol:												
[1]FdG:												
Foxol part-----	D	None--------	---	---	>6.0	---	---	14-20	Hard	---	---	Moderate.
Durfee part----	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]FrG:												
Foxol part-----	D	None--------	---	---	>6.0	---	---	14-20	Hard	---	---	Moderate.
Rock outcrop part.												
Geertsen:												
GaG--------------	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
[1]GcG:												
Geertsen part--	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Agassiz part---	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate.
Guilder:												
GeE--------------	C	None--------	---	---	>6.0	---	---	>50	Rip-pable	---	---	Moderate.
Hades:												
HaC, HaG---------	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Hawkins:												
HbC, HbD, HbE----	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]HcE:												
Hawkins part---	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Collinston part	B	None--------	---	---	>6.0	---	---	>60	---	---	---	High.
Henefer:												
HeD, HeG---------	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Henhoit:												
HpG--------------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Herd:												
HrC--------------	C	None--------	---	---	>6.0	---	---	40-60	Rip-pable	---	---	Moderate.
[1]HtC:												
Herd part------	C	None--------	---	---	>6.0	---	---	40-60	Rip-pable	---	---	Moderate.
Yence part-----	C	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Holmes:												
HuC--------------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Horrocks:												
[1]HvG:												
Horrocks part--	B	None--------	---	---	>6.0	---	---	40-50	Hard	---	---	Moderate.
Rock outcrop part.												
Hoskin:												
HwG--------------	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	
					Ft			In		In		
Hoskin:												
[1]HxG:												
Hoskin part----	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---	Moderate.
Rock outcrop part.												
Isbell:												
IbG--------------	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
IgD--------------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Kahler:												
KaB, KaC---------	B	None--------	---	---	>6.0	---	---	40-60	Hard	---	---	Moderate.
Kilfoil:												
KfF--------------	C	None--------	---	---	>6.0	---	---	24-40	Rip-pable	---	---	Moderate.
[1]KrG:												
Kilfoil part---	C	None--------	---	---	>6.0	---	---	24-40	Rip-pable	---	---	Moderate.
Rock outcrop part.												
Lamondi:												
LaD, LaE---------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Lithic Haploxerolls:												
[1]LHG:												
Lithic Haploxerolls part----------	D	None--------	---	---	>6.0	---	---	8-20	Hard	---	---	Low.
Rock outcrop part.												
Lucky Star:												
LkD, LkG---------	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]LmG:												
Lucky Star part	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Charcol part---	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]LNG:												
Lucky Star part	B	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Ercan part-----	B	None--------	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Manila:												
MbA, MbB, MbC, MbD, MbE---------	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]McD, [1]McG:												
Manila part----	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Yeates Hollow part----------	C	None--------	---	---	>6.0	---	---	42-60	Hard	---	---	Moderate.
Mondey:												
MeD, MeE---------	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Morgala:												
MoG--------------	C	None--------	---	---	>6.0	---	---	>60	---	---	---	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Cemented pan: Depth	Cemented pan: Hardness	Potential frost action
					Ft			In		In		
Morgala:												
[1]MrG:												
Morgala part	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Rock outcrop part.												
Moweba:												
MwC, MwG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]MyG:												
Moweba part	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
St. Marys part	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Nagitsy:												
NAE	C	None	---	---	>6.0	---	---	20-40	Hard	---	---	Moderate.
[1]NcG:												
Nagitsy part	C	None	---	---	>6.0	---	---	24-40	Hard	---	---	Moderate.
Rock outcrop part.												
[1]NDG:												
Nagitsy part	C	None	---	---	>6.0	---	---	24-40	Hard	---	---	Moderate.
Broad Canyon part	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Rock outcrop part.												
[1]NPG:												
Nagitsy part	C	None	---	---	>6.0	---	---	24-40	Hard	---	---	Moderate.
Patio part	C	None	---	---	>6.0	---	---	20-36	Hard	---	---	Moderate.
Rock outcrop part.												
Nebeker:												
NrA, NrB	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Nicodemus:												
NsA	B	Occasional	Very long	Mar-May	2.0-4.0	Apparent	Mar-Jun	>60	---	---	---	Moderate.
Norcan:												
NtG	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Nordic:												
NuG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]NVG:												
Nordic part	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Patio part	C	None	---	---	>6.0	---	---	20-36	Hard	---	---	Moderate.
Ostler:												
OaG	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
[1]OcG:												
Ostler part	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Causey part	B	None	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
[1]ODG:												
Ostler part	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Bertag part	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	
					Ft			In		In		
Parleys:												
PaA	B	None	---	---	>6.0	---	---	>60	---	---	---	High.
Parlo:												
PcA	B	None	---	---	>6.0	---	---	>60	---	---	---	High.
Patio:												
PdG	C	None	---	---	>6.0	---	---	20-36	Hard	---	---	Moderate.
Phoebe:												
PhA	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Poleline:												
PoG	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
[1]PPG:												
Poleline part	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Patio part	C	None	---	---	>6.0	---	---	20-36	Hard	---	---	Moderate.
Pringle:												
PrA	C	Common	Long	Feb-Jun	1.0-2.0	Apparent	Feb-Jun	>60	---	---	---	Moderate.
Redcan:												
[1]RaG:												
Redcan part	D	None	---	---	>6.0	---	---	15-20	Rip-pable	---	---	Moderate.
Etchen part	C	None	---	---	>6.0	---	---	21-40	Hard	---	---	Moderate.
[1]RcG:												
Redcan part	D	None	---	---	>6.0	---	---	15-20	Rip-pable	---	---	Moderate.
Rock outcrop part.												
Redola:												
ReA	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Richens:												
RhC	C	None	---	---	>6.0	---	---	>55	Rip-pable	---	---	Moderate.
Richville:												
RvG	C	None	---	---	>6.0	---	---	28-40	Rip-pable	---	---	Moderate.
Rock outcrop:												
RX.												
Scave:												
SaD, SaG	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Schuster:												
ScG	B	None	---	---	>6.0	---	---	>40	Rip-pable	---	---	Moderate.
Sessions:												
SeD	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Smarts:												
SfG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
SgG	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Steed:												
SmA, SnA	A	Rare to common.	Long	Mar-Jun	>4.0	Apparent	Apr-Jun	>60	---	---	---	Moderate.
St. Marys:												
SoG, SrG	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.

See footnotes at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Cemented pan: Depth	Cemented pan: Hardness	Potential frost action
					Ft			In		In		
St. Marys:												
[1]SsD:												
St. Marys part	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Guilder part	C	None	---	---	>6.0	---	---	>50	Rip-pable	---	---	Moderate.
[1]StG:												
St. Marys part	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Hoskin part	C	None	---	---	>6.0	---	---	20-40	Hard	---	---	Moderate.
Stoda: SuD, SuG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Sunset: SwA	B	Occasional	Very long	Mar-May	2.5-3.0	Apparent	Mar-Jul	>60	---	---	---	Moderate.
Toncana: TaG	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Toone: TeG	C	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Trojan: TnA, TnD	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate.
Utaba: UaA, UbA, UcA	A	Rare to common.	Long	Mar-May	>6.0	---	---	>60	---	---	---	Low.
Yeates Hollow: YaA, YbC, YcD	C	None	---	---	>6.0	---	---	42-60	Hard	---	---	Moderate.
[1]YdG:												
Yeates Hollow part	C	None	---	---	>6.0	---	---	42-60	Hard	---	---	Moderate.
Smarts part	B	None	---	---	>6.0	---	---	>40	Hard	---	---	Moderate.
Yeljack: YeD, YeE	B	None	---	---	>6.0	---	---	>55	Rip-pable	---	---	Moderate.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Agassiz	Loamy-skeletal, mixed, frigid Lithic Haploxerolls
Ant Flat	Fine, montmorillonitic, frigid Calcic Argixerolls
Bertag	Fine, montmorillonitic, frigid Pachic Ultic Argixerolls
Broad Canyon	Loamy-skeletal, mixed Typic Cryoborolls
Broadhead	Fine, montmorillonitic, frigid Pachic Argixerolls
Brownlee	Fine-loamy, mixed, mesic Ultic Argixerolls
Bullnel	Fine-loamy, mixed, frigid Mollic Haploxeralfs
Burgi	Loamy-skeletal, mixed, frigid Cumulic Haploxerolls
Caballo	Loamy-skeletal, mixed Pachic Cryoborolls
Canburn	Fine-loamy, mixed (calcareous), frigid Cumulic Haplaquolls
Causey	Fine-loamy, mixed, frigid Calcic Haploxerolls
Charcol	Loamy-skeletal, mixed Cryic Pachic Paleborolls
Choptie	Loamy, mixed, frigid Lithic Haploxerolls
Cloud Rim	Fine-loamy, mixed, frigid Typic Argixerolls
Collinston	Fine-silty, mixed, mesic Typic Calcixerolls
Condie	Loamy-skeletal, mixed Mollic Cryoboralfs
Cristo	Fine, montmorillonitic, frigid Pachic Argixerolls
Crooked Creek	Fine, montmorillonitic, frigid Cumulic Haplaquolls
Croydon	Fine-loamy, mixed Argic Cryoborolls
Cumulic Haploborolls	Cumulic Haploborolls
Cumulic Haploxerolls	Cumulic Haploxerolls
Donner	Fine, montmorillonitic, frigid Ultic Argixerolls
Durfee	Clayey-skeletal, montmorillonitic, frigid Typic Palexerolls
Durst	Loamy-skeletal, mixed, frigid Ultic Argixerolls
Eastcan	Fine-loamy, mixed, mesic Cumulic Haploxerolls
Eastcan variant	Fine-loamy, mixed, mesic Cumulic Haploxerolls
Ercan	Fine-loamy, mixed Cryic Paleborolls
Etchen	Loamy-skeletal, mixed, frigid Mollic Haploxeralfs
Fluvaquentic Haploborolls	Fluvaquentic Haploborolls
Fluventic Haploxerolls	Fluventic Haploxerolls
Flygare	Loamy-skeletal, mixed Cryic Pachic Paleborolls
Foxol	Loamy-skeletal, mixed, frigid Lithic Haploxerolls
Geertsen	Loamy-skeletal, mixed Argic Cryoborolls
Guilder	Fine, mixed, frigid Mollic Haploxeralfs
Hades	Fine-loamy, mixed, frigid Pachic Argixerolls
Hawkins	Fine, montmorillonitic, frigid Vertic Haploxerolls
Henefer	Fine, montmorillonitic, frigid Pachic Argixerolls
Henhoit	Loamy-skeletal, mixed, frigid Ultic Argixerolls
Herd	Fine, montmorillonitic Mollic Cryoboralfs
Holmes	Loamy-skeletal, mixed, frigid Typic Argixerolls
Horrocks	Loamy-skeletal, mixed, frigid Typic Argixerolls
Hoskin	Loamy-skeletal, mixed, frigid Typic Argixerolls
Isbell	Fine-loamy, mixed, frigid Typic Argixerolls
Kahler	Fine-loamy, mixed, frigid Pachic Ultic Haploxerolls
Kilfoil	Fine-loamy, mixed, frigid Mollic Haploxeralfs
Lamondi	Loamy-skeletal, mixed, frigid Pachic Ultic Haploxerolls
Lithic Haploxerolls	Lithic Haploxerolls
Lucky Star	Loamy-skeletal, mixed Cryic Paleborolls
Manila	Fine, montmorillonitic, frigid Typic Argixerolls
Mondey	Fine, montmorillonitic, frigid Vertic Argixerolls
Morgala	Fine, montmorillonitic, frigid Mollic Haploxeralfs
Moweba	Loamy-skeletal, mixed, frigid Pachic Ultic Haploxerolls
Nagitsy	Loamy-skeletal, mixed Pachic Cryoborolls
Nebeker	Fine, montmorillonitic, mesic Pachic Argixerolls
Nicodemus	Loamy-skeletal, mixed, mesic Cumulic Ultic Haploxerolls
Norcan	Fine, montmorillonitic, frigid Typic Palexerolls
Nordic	Loamy-skeletal, mixed Cryic Paleborolls
Ostler	Fine, montmorillonitic, frigid Typic Argixerolls
Parleys	Fine-silty, mixed, mesic Calcic Argixerolls
Parlo	Fine-silty over sandy or sandy-skeletal, mixed, mesic Calcic Argixerolls
Patio	Loamy-skeletal, mixed, frigid Ultic Haploxerolls
Phoebe	Coarse-loamy, mixed, mesic Typic Haploxerolls
Poleline	Loamy-skeletal, mixed Pachic Cryoborolls
Pringle	Coarse-loamy over fragmental, mixed Fluvaquentic Haploborolls
Redcan	Loamy-skeletal, mixed (calcareous), frigid, shallow Typic Xerorthents
Redola	Coarse-loamy, mixed, mesic Cumulic Haploxerolls
Richens	Fine, montmorillonitic Argic Pachic Cryoborolls
Richville	Fine-loamy, mixed, frigid Calcixerollic Xerochrepts
Scave	Clayey-skeletal, montmorillonitic Abruptic Cryic Paleborolls
Schuster	Loamy-skeletal, mixed Cryic Paleborolls
Sessions	Fine, montmorillonitic Argic Cryoborolls
Smarts	Loamy-skeletal, mixed, frigid Pachic Ultic Argixerolls

TABLE 15.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Steed	Fragmental, mixed, mesic Entic Haploxerolls
St. Marys	Loamy-skeletal, mixed, frigid Typic Haploxerolls
Stoda	Fine-loamy, mixed, mesic Typic Calcixerolls
Sunset	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Toncana	Loamy-skeletal, mixed, frigid Pachic Ultic Argixerolls
Toone	Clayey-skeletal, montmorillonitic Cryic Pachic Paleborolls
Trojan	Fine-loamy, mixed, frigid Ultic Argixerolls
Utaba	Loamy-skeletal over fragmental, mixed, frigid Cumulic Haploxerolls
Wallsburg	Clayey-skeletal, montmorillonitic, frigid Lithic Argixerolls
Yeates Hollow	Clayey-skeletal, montmorillonitic, frigid Typic Argixerolls
Yeljack	Fine-loamy, mixed Cryic Pachic Paleborolls
Yence	Clayey-skeletal, montmorillonitic Mollic Cryoboralfs

TABLE 16.--TEMPERATURE AND PRECIPITATION DATA

[Morgan, Utah, 1941-1970]

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with-- Maximum temperature equal or >	Minimum temperature equal or <	Average monthly total	One year in 10 will have Less than	More than	Average snowfall
	°F	°F	°F	°F	In	In	In	In
January	35.5	10.2	49	- 9	1.66	0.57	4.01	10.2
February	40.8	15.0	53	- 2	1.45	.55	3.63	5.9
March	48.3	21.0	64	7	1.75	.75	3.40	7.9
April	59.9	29.2	74	19	1.84	.78	2.77	2.9
May	70.9	36.1	83	27	1.64	.32	2.97	.2
June	79.5	41.1	93	33	1.55	.07	2.58	0
July	89.9	47.2	96	39	.42	.03	1.40	0
August	87.0	46.0	95	36	.96	.05	2.72	0
September	78.0	36.8	89	27	.87	.02	2.23	0
October	66.1	29.1	79	20	1.39	.20	3.15	.4
November	48.5	20.3	64	3	1.68	.32	3.01	3.7
December	38.1	13.7	50	- 5	1.87	.44	3.58	18.1
Annual	61.9	28.8	--	--	17.08	11.13	24.95	49.3

[Pine View Dam, Utah, 1941-1970]

Month	Average daily maximum	Average daily minimum	Maximum temperature equal or >	Minimum temperature equal or <	Average monthly total	Less than	More than	Average snowfall
January	30.6	8.9	45	-14	3.28	0.81	6.45	33.3
February	36.3	12.6	50	- 8	2.84	1.01	5.65	24.2
March	44.7	20.4	60	1	3.13	.73	5.08	20.4
April	57.5	32.1	74	22	3.07	1.48	5.61	5.7
May	68.9	39.7	82	29	2.47	.76	4.47	.9
June	77.2	45.3	91	36	1.67	.18	4.12	([1])
July	88.3	52.5	96	43	.56	([1])	1.41	0
August	86.0	51.2	93	39	1.27	.05	3.39	0
September	76.4	42.4	88	31	1.84	.23	3.12	([1])
October	63.6	33.8	79	24	2.24	.44	4.44	1.1
November	44.3	23.2	61	8	3.07	.64	5.49	11.8
December	33.8	14.5	47	3	3.26	1.60	5.71	24.9
Annual	59.0	31.4	--	--	28.70	25.46	37.05	122.3

[1]Trace.

TABLE 17.--PROBABILITY OF LAST FREEZING TEMPERATURES IN SPRING AND FIRST IN FALL

[Morgan, Utah]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than----	April 18	April 30	May 15	June 5	June 25
1 year in 4 later than----	April 9	April 20	May 5	May 26	June 16
1 year in 2 later than----	April 1	April 10	April 25	May 15	June 6
Fall:					
1 year in 10 earlier than--	October 17	October 1	September 20	September 4	August 22
1 year in 4 earlier than--	October 26	October 10	September 28	September 12	August 30
1 year in 2 earlier than--	November 5	October 18	October 5	September 20	September 7

[Pineview Dam, Utah]

Probability	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than----	April 9	April 23	May 8	May 23	June 10
1 year in 4 later than----	April 1	April 14	April 29	May 14	June 1
1 year in 2 later than----	March 20	April 5	April 19	May 4	May 22
Fall:					
1 year in 10 earlier than--	October 26	October 15	October 5	August 21	August 5
1 year in 4 earlier than--	November 4	October 22	October 13	August 30	August 13
1 year in 2 earlier than--	November 12	October 31	October 21	September 9	August 22

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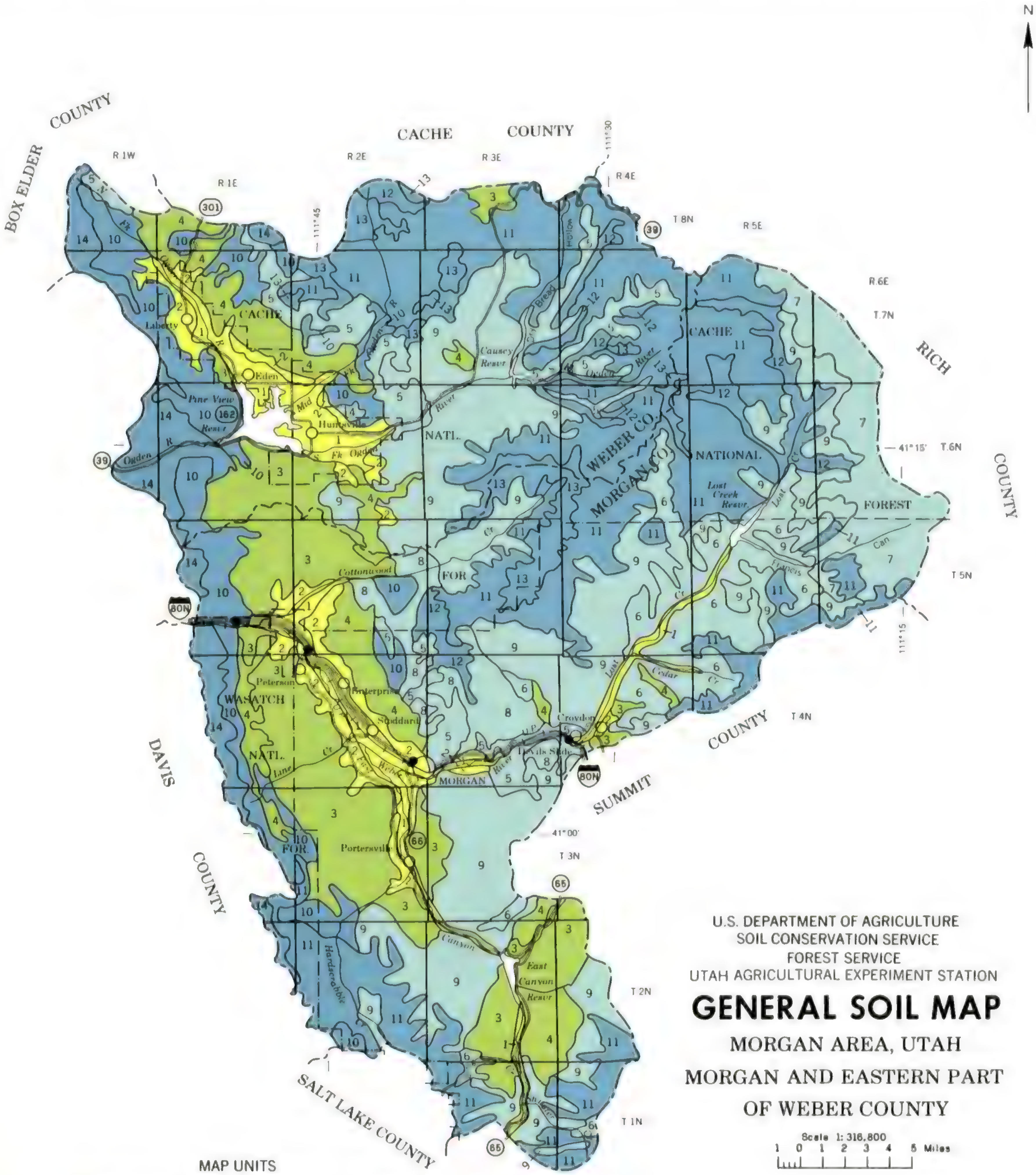


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MORGAN AREA, UTAH
MORGAN AND EASTERN PART OF WEBER COUNTY

Scale 1: 316,800

1 0 1 2 3 4 5 Miles

SUMMIT COUNTY

MAP UNITS

POORLY DRAINED TO WELL DRAINED SOILS ON VALLEY BOTTOMS, ALLUVIAL PLAINS, LOW ALLUVIAL FANS, AND TERRACES

1 Utaba-Eastcan-Pringle: Very deep, well drained to poorly drained soils that formed in alluvium on valley bottoms, alluvial fans, alluvial plains, and stream terraces

2 Manila-Stoda-Nebeker: Very deep, well drained soils that formed in mixed lake sediments and alluvium on lake terraces, stream terraces, and alluvial fans

WELL DRAINED SOILS ON MOUNTAIN FOOT SLOPES, FOOTHILLS, LOWER MOUNTAINSIDES, AND ASSOCIATED ALLUVIAL FANS AND TERRACES

3 Hawkins-Ostler-Manila: Very deep or moderately deep, well drained soils on foothills, mountain foot slopes, alluvial fans, and mountainsides

4 Durfee-Yeates Hollow: Very deep or deep, well drained soils on alluvial fans, mountain foot slopes, and mountainsides

WELL DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS ON MOUNTAIN RIDGES, MOUNTAINSIDES, CANYON WALLS, AND ASSOCIATED FANS AND TERRACES, AND ROCK OUTCROP

5 Agassiz-Foxol-Rock outcrop: Shallow, somewhat excessively drained soils on mountainsides and canyon walls, and Rock outcrop

6 Isbell-Hades-Kilfoil: Very deep to moderately deep, well drained soils on mountainsides

7 Etchen-Bullnel-Guilder: Moderately deep and deep, well drained soils on mountainsides

8 Durst-Smarts-Burgi: Moderately deep to very deep, well drained soils on mountainsides

9 St. Marys-Moweba-Hoskin: Moderately deep to very deep, well drained soils on mountainsides

WELL DRAINED SOILS ON MOUNTAINSIDES, HIGH MOUNTAINSIDES, AND ASSOCIATED MOUNTAINTOPS, RIDGES, AND CANYON WALLS

10 Poleline-Smarts-Patio: Deep and moderately deep, well drained soils on mountainsides and high mountainsides

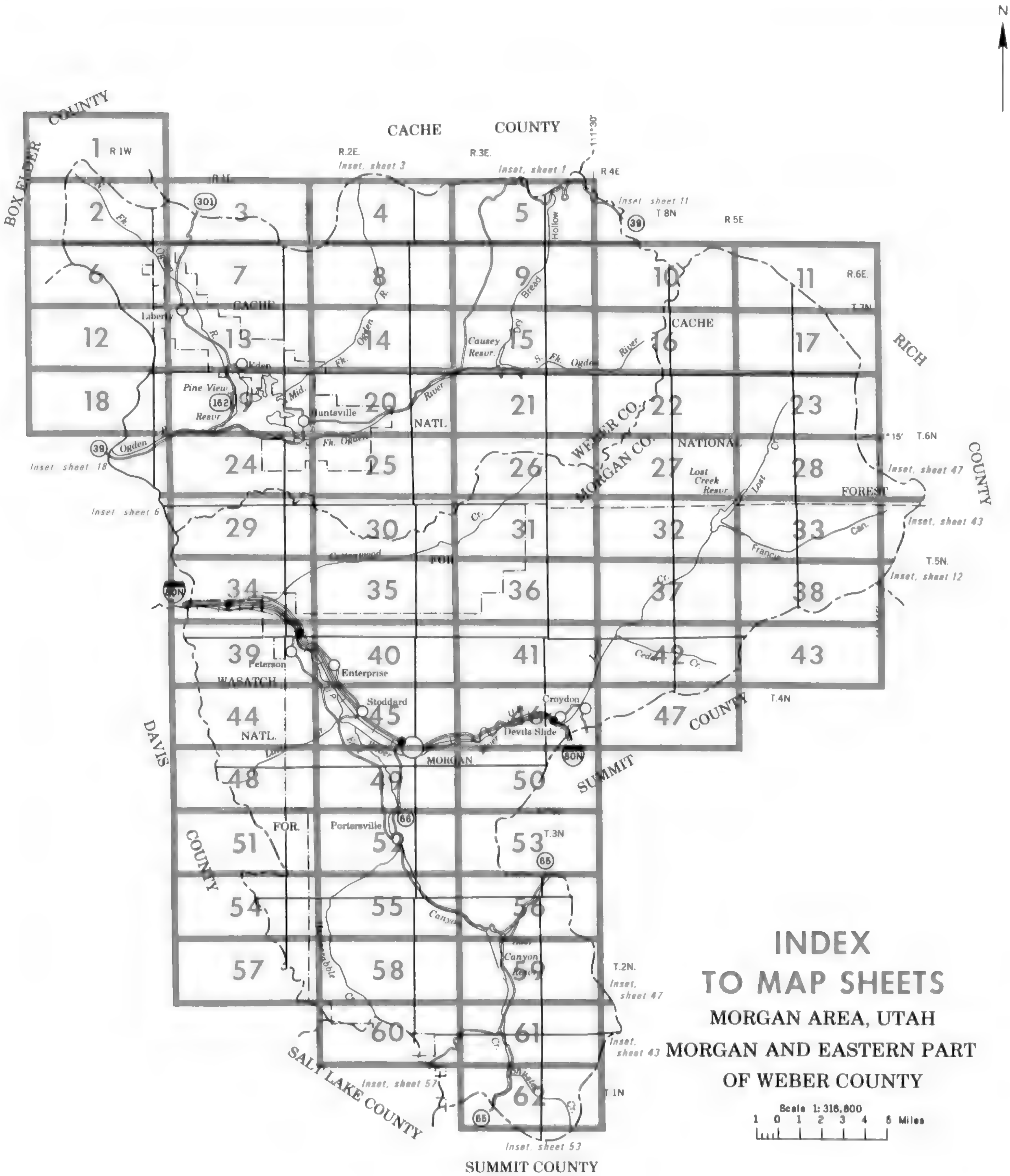
11 Lucky Star-Charcol: Very deep, well drained soils on high mountainsides

12 Geertsen-Broad Canyon-Cristo: Moderately deep to very deep, well drained soils on mountainsides and high mountainsides

13 Herd-Richens-Yence: Deep to very deep, well drained soils on high mountaintops

14 Nagitsy-Rock outcrop-Broad Canyon: Moderately deep and very deep, well drained soils on subalpine and high mountainsides and canyon walls

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

MORGAN AREA, UTAH

MORGAN AND EASTERN PART OF WEBER COUNTY

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — SvE 107

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow pit — B P
- Glacial till

SOIL LEGEND

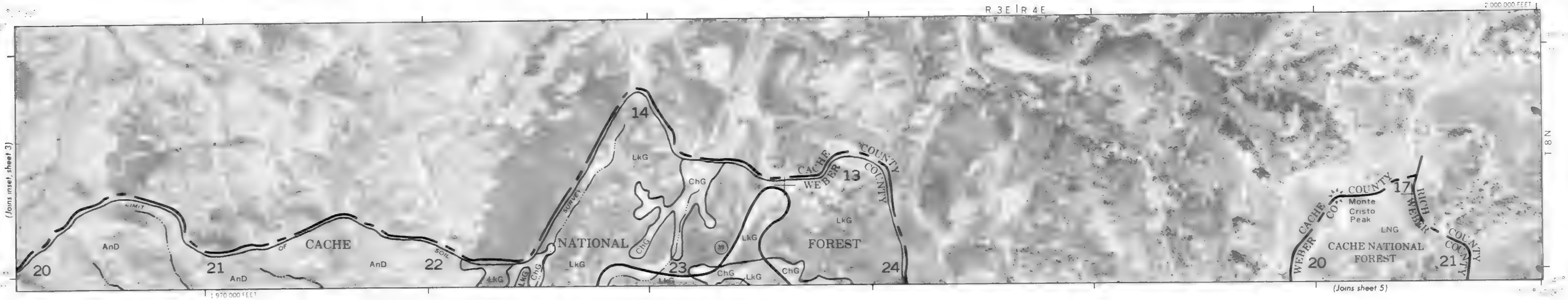
The first letter, always a capital, is the initial one of the map unit. The second letter is a capital if the map unit is one of the low intensity survey; it is a small letter if the map unit is one of the high intensity survey.

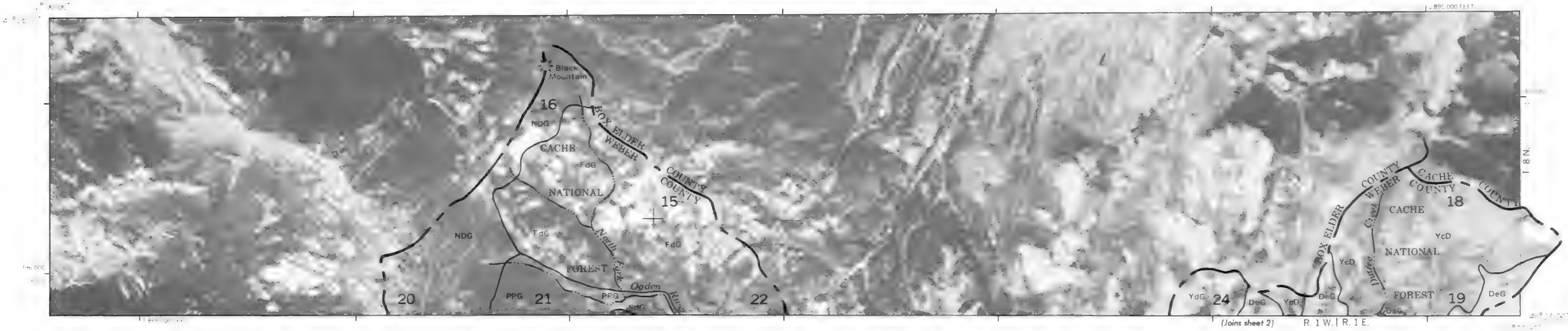
SYMBOL	NAME
AaG	Agassiz-Rock outcrop complex, 40 to 70 percent slopes
AbG	Agassiz-Rock outcrop complex, shallow, 40 to 70 percent slopes
AGG	Agassiz-Geertsen-Rock outcrop association, very steep*
AnD	Ant Flat loam, 6 to 15 percent slopes
BAF	Bertag silt loam, 10 to 30 percent slopes*
BbG	Bertag silt loam, 30 to 50 percent slopes
BcE	Bertag cobbly loam, 20 to 40 percent slopes
BdG	Broad Canyon stony loam, 30 to 70 percent slopes
BeB	Broadhead clay loam, 2 to 5 percent slopes
BfA	Brownlee loam, 0 to 3 percent slopes
BfB	Brownlee loam, 3 to 6 percent slopes
BnC2	Bullnel gravelly loam, 2 to 15 percent slopes, eroded
BnG	Bullnel gravelly loam, 30 to 50 percent slopes
BuG	Burgi loam, 40 to 70 percent slopes
CaG	Caballo gravelly loam, 40 to 70 percent slopes
Cb	Canburn silt loam
CdG	Causey silt loam, 30 to 60 percent slopes
CeG	Causey-Choptie silt loams, 30 to 60 percent slopes
ChG	Charcol gravelly fine sandy loam, 30 to 50 percent slopes
CnG	Cloud Rim loam, 30 to 60 percent slopes
CoG	Condie gravelly loam, 30 to 60 percent slopes
CrG	Cristo-Wallsburg complex, 40 to 60 percent slopes
Ct	Crooked Creek silty clay loam
CvG	Croydon loam, 30 to 60 percent slopes
CW	Cumulic Haploborolls, wet*
CX	Cumulic Haploxerolls, loamy*
DaG	Donner cobbly loam, 30 to 50 percent slopes
DbE	Donner-Bertag cobbly loams, 10 to 40 percent slopes
DeG	Durfee stony loam, 30 to 70 percent slopes
DmG	Durfee Moweba complex, 30 to 70 percent slopes
DuG	Durst gravelly loam, 40 to 70 percent slopes
EaA	Eastcan loam, 0 to 3 percent slopes
EcA	Eastcan loam, cool, 0 to 3 percent slopes
EdC	Eastcan variant loam, 6 to 10 percent slopes
EeC	Eastcan variant loam, cool, 6 to 10 percent slopes
ErD	Ercan loam, 3 to 15 percent slopes
ErE	Ercan loam, 15 to 30 percent slopes
ErG	Ercan loam, 30 to 60 percent slopes
EtG	Etchen very cobbly loam, 25 to 50 percent slopes
EVG	Etchen-Henhoit association, very steep*
EXG	Etchen-Schuster association, very steep*
FAB	Fluvaquentic Haploborolls-Fluventic Haploxerolls complex, 1 to 6 percent slopes*
FcG	Flygare loam, 30 to 60 percent slopes
FdG	Foxol-Durfee complex, 30 to 70 percent slopes
FrG	Foxol Rock outcrop complex, 40 to 70 percent slopes
GaG	Geertsen loam, 30 to 70 percent slopes
GcG	Geertsen-Agassiz complex, 30 to 70 percent slopes
GeE	Guilder loam, 15 to 30 percent slopes
HaC	Hades loam, 6 to 15 percent slopes
HaG	Hades loam, 40 to 60 percent slopes
HbC	Hawkins silty clay, 3 to 6 percent slopes
HbD	Hawkins silty clay, 6 to 15 percent slopes
HbE	Hawkins silty clay, 15 to 30 percent slopes
HcE	Hawkins-Collinston complex, 6 to 30 percent slopes
HeD	Henefer loam, 6 to 15 percent slopes
HeG	Henefer loam, 40 to 60 percent slopes
HpG	Henhoit gravelly loam, 30 to 60 percent slopes
HrC	Herd cobbly clay loam, 3 to 15 percent slopes
HtC	Herd-Yence complex, 3 to 15 percent slopes
HuC	Holmes very stony loam, high rainfall, 3 to 10 percent slopes
HvG	Horrocks-Rock outcrop complex, 40 to 70 percent slopes
HwG	Hoskin cobbly loam, 30 to 50 percent slopes
HxG	Hoskin-Rock outcrop complex, 50 to 70 percent slopes
IbG	Isbell loam, 40 to 60 percent slopes
IgD	Isbell loam, gravelly substratum, 6 to 15 percent slopes
KaB	Kahler gravelly loam, 3 to 6 percent slopes
KaC	Kahler gravelly loam, 6 to 10 percent slopes
KfF	Kilfoil loam, 25 to 40 percent slopes
KrG	Kilfoil-Rock outcrop complex, 40 to 60 percent slopes
LaD	Lamondi stony loam, 3 to 15 percent slopes
LaE	Lamondi stony loam, 15 to 30 percent slopes
LHG	Lithic Haploxerolls Rock outcrop complex, 40 to 80 percent slopes*
LkD	Lucky Star silt loam, 15 to 30 percent slopes
LkG	Lucky Star silt loam, 30 to 60 percent slopes
LmG	Lucky Star-Charcol complex, 30 to 60 percent slopes
LNG	Lucky Star Ercan association, very steep*
MbA	Manila loam, 0 to 3 percent slopes
MbB	Manila loam, 3 to 6 percent slopes
MbC	Manila loam, 6 to 10 percent slopes
MbD	Manila loam, 10 to 25 percent slopes
MbE	Manila loam, 25 to 40 percent slopes
McD	Manila-Yeates Hollow complex, 10 to 25 percent slopes
McG	Manila Yeates Hollow complex, 25 to 70 percent slopes
MeD	Mondey clay loam, 8 to 15 percent slopes
MeE	Mondey clay loam, 15 to 30 percent slopes
MoG	Morgala loam, 30 to 60 percent slopes
MrG	Morgala-Rock outcrop complex, 30 to 60 percent slopes
MwC	Moweba gravelly loam, 6 to 15 percent slopes
MwG	Moweba gravelly loam, 30 to 50 percent slopes
MyG	Moweba-St Marys complex, 30 to 50 percent slopes
NaE	Nagitsy gravelly loam, 10 to 30 percent slopes*
NcG	Nagitsy Rock outcrop complex, 50 to 70 percent slopes
NDG	Nagitsy Broad Canyon Rock outcrop association, very steep*
NPG	Nagitsy Patio Rock outcrop association, very steep*
NrA	Nebeker clay loam, 0 to 3 percent slopes
NrB	Nebeker clay loam, 3 to 6 percent slopes
NsA	Nicodemus gravelly loam, 0 to 3 percent slopes
NtG	Norcan loam, 30 to 60 percent slopes
NuG	Nordic gravelly loam, 30 to 60 percent slopes
NvG	Nordic Patio association, very steep*
OaG	Ostler loam, 20 to 50 percent slopes
OcG	Ostler-Causey complex, 20 to 60 percent slopes
ODG	Ostler-Bertag association, very steep*
PaA	Parleys loam, high rainfall, 0 to 3 percent slopes
PcA	Parlo loam, 0 to 3 percent slopes
PdG	Patio gravelly loam, 40 to 60 percent slopes
PhA	Phoebe fine sandy loam, 0 to 3 percent slopes
PoG	Poleline stony loam, 40 to 70 percent slopes
PPG	Poleline-Patio association, very steep*
PrA	Pringle loam
RaG	Redcan-Etchen complex, 25 to 60 percent slopes
RcG	Redcan Rock outcrop complex, 40 to 60 percent slopes
ReA	Redola loam, 0 to 2 percent slopes
RhC	Richens loam, 3 to 15 percent slopes
RvG	Richville gravelly loam, 30 to 60 percent slopes
RX	Rock outcrop*
SaD	Scave loam, 15 to 30 percent slopes
SaG	Scave loam, 30 to 60 percent slopes
ScG	Schuster loam, 30 to 60 percent slopes
SeD	Sessions cobbly loam, 15 to 25 percent slopes
StG	Smarts loam, 40 to 60 percent slopes
SgG	Smarts loam, moderately deep, 40 to 70 percent slopes
SmA	Steed loam, 0 to 1 percent slopes
SnA	Steed cobbly loam, 0 to 3 percent slopes
SoG	St Marys cobbly loam, 30 to 50 percent slopes
SrG	St Marys very stony loam, 40 to 60 percent slopes
SsD	St Marys-Guilder complex, 3 to 25 percent slopes
StG	St Marys-Hoskin cobbly loams, 30 to 50 percent slopes
SuD	Stoda loam, 10 to 25 percent slopes
SuG	Stoda loam, 40 to 60 percent slopes
SwA	Sunset loam, very gravelly substratum
TaG	Toncana loam, 40 to 60 percent slopes
TeG	Toone loam, 40 to 60 percent slopes
TnA	Trojan loam, warm, 0 to 3 percent slopes
TnD	Trojan loam, warm, 8 to 15 percent slopes
UaA	Utaba cobbly loam
UbA	Utaba cobbly loam, warm
UcA	Utaba loam, warm
YaA	Yeates Hollow loam, 2 to 5 percent slopes
YbC	Yeates Hollow cobbly loam, 6 to 10 percent slopes
YcD	Yeates Hollow very stony loam, 10 to 30 percent slopes
YdG	Yeates Hollow Smarts complex, 30 to 70 percent slopes
YeD	Yeljack loam, 6 to 15 percent slopes
YeE	Yeljack loam, 15 to 30 percent slopes

*Broadly defined units

1

N

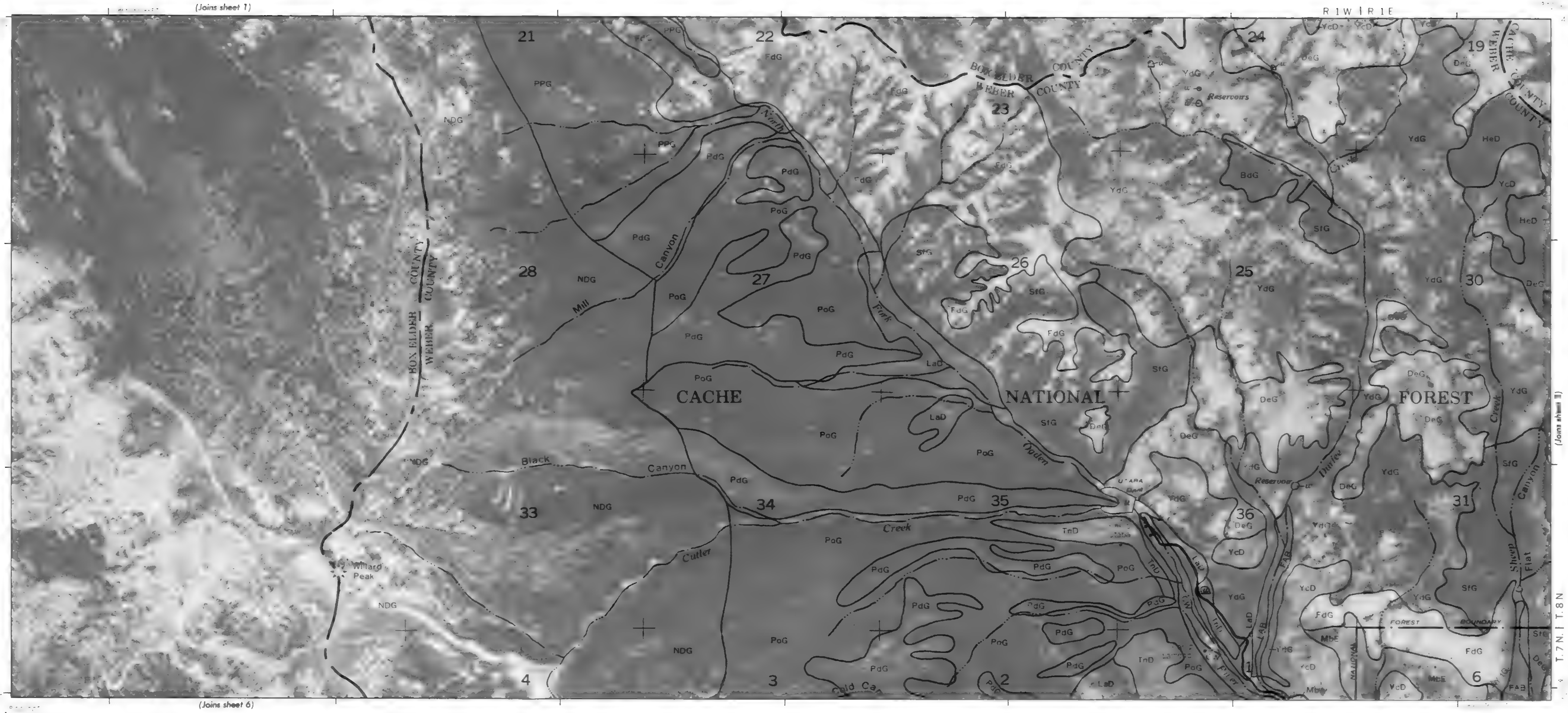




1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

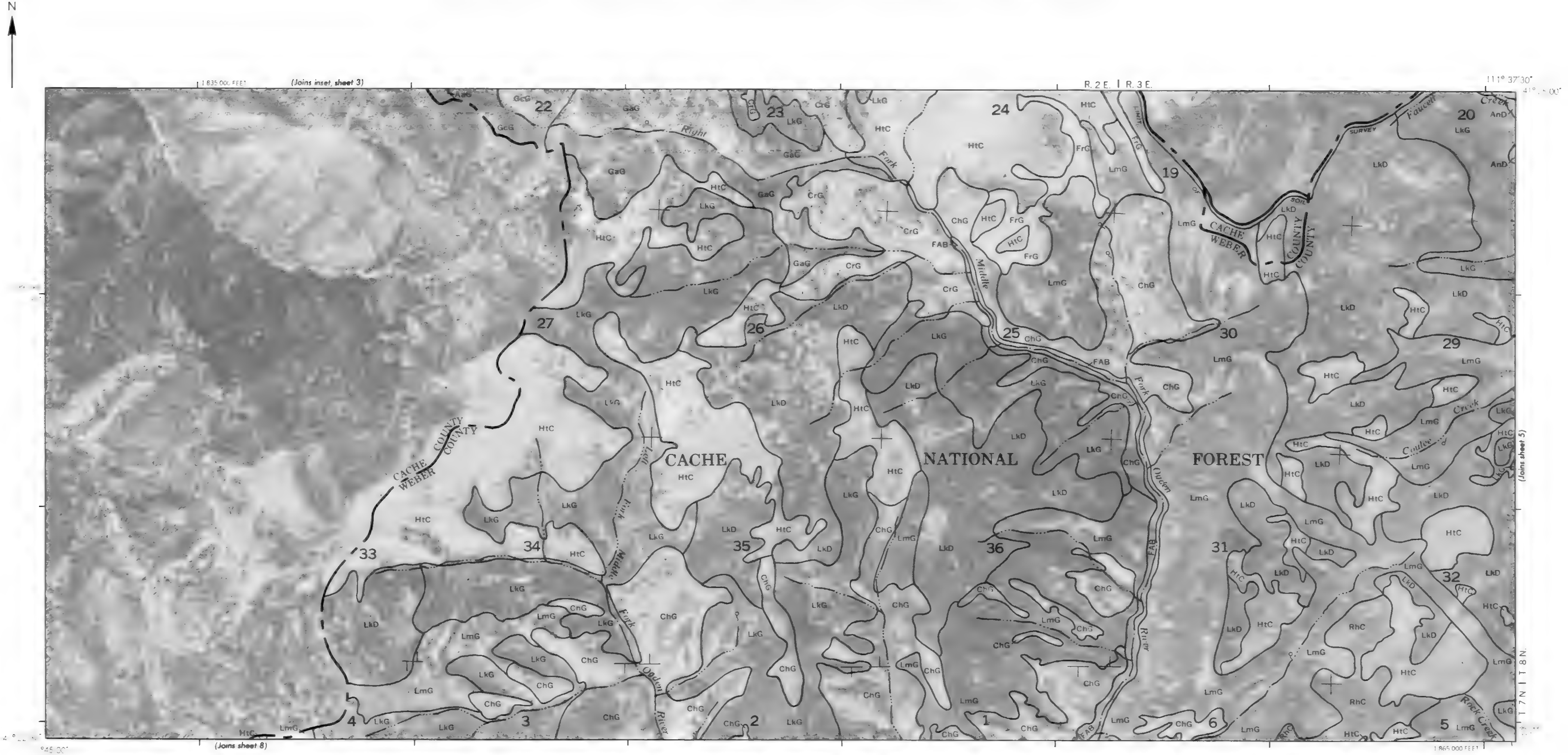
Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

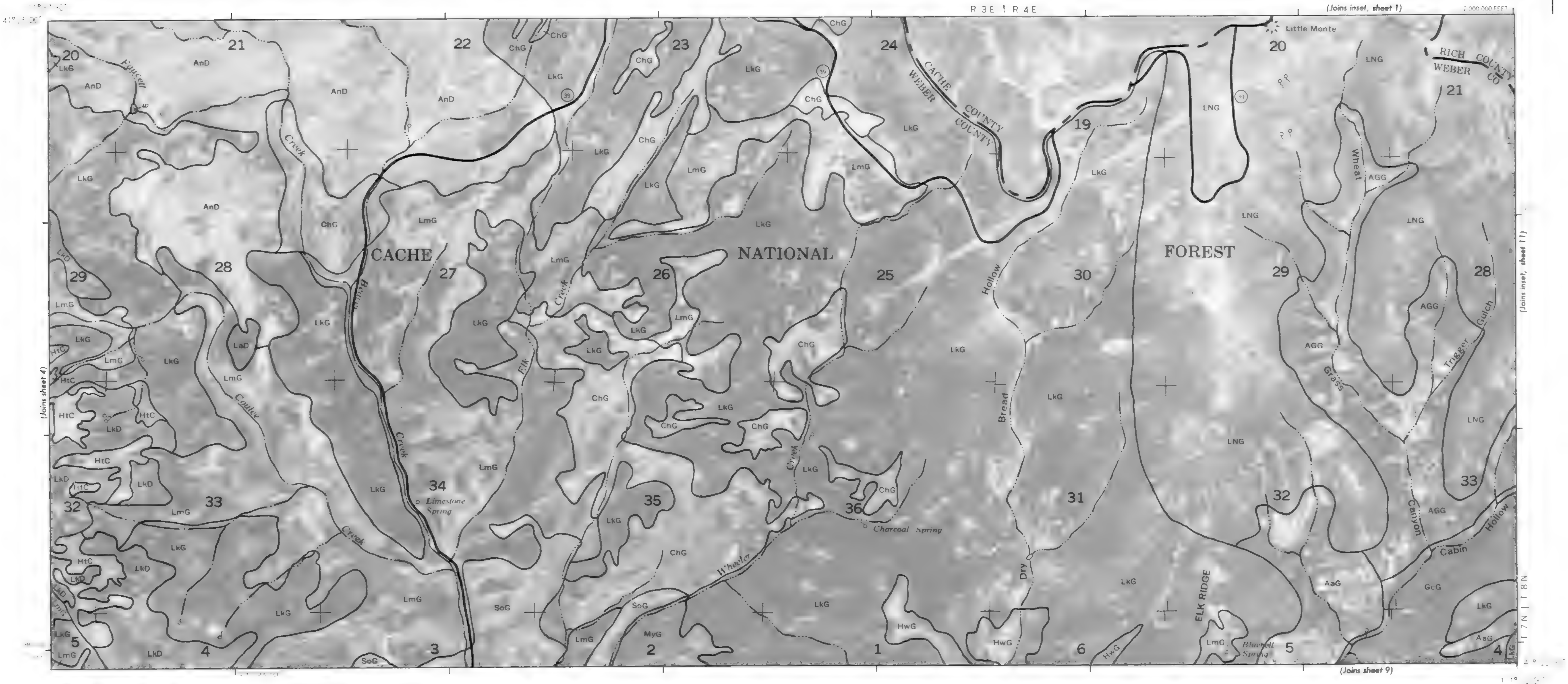
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 4



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

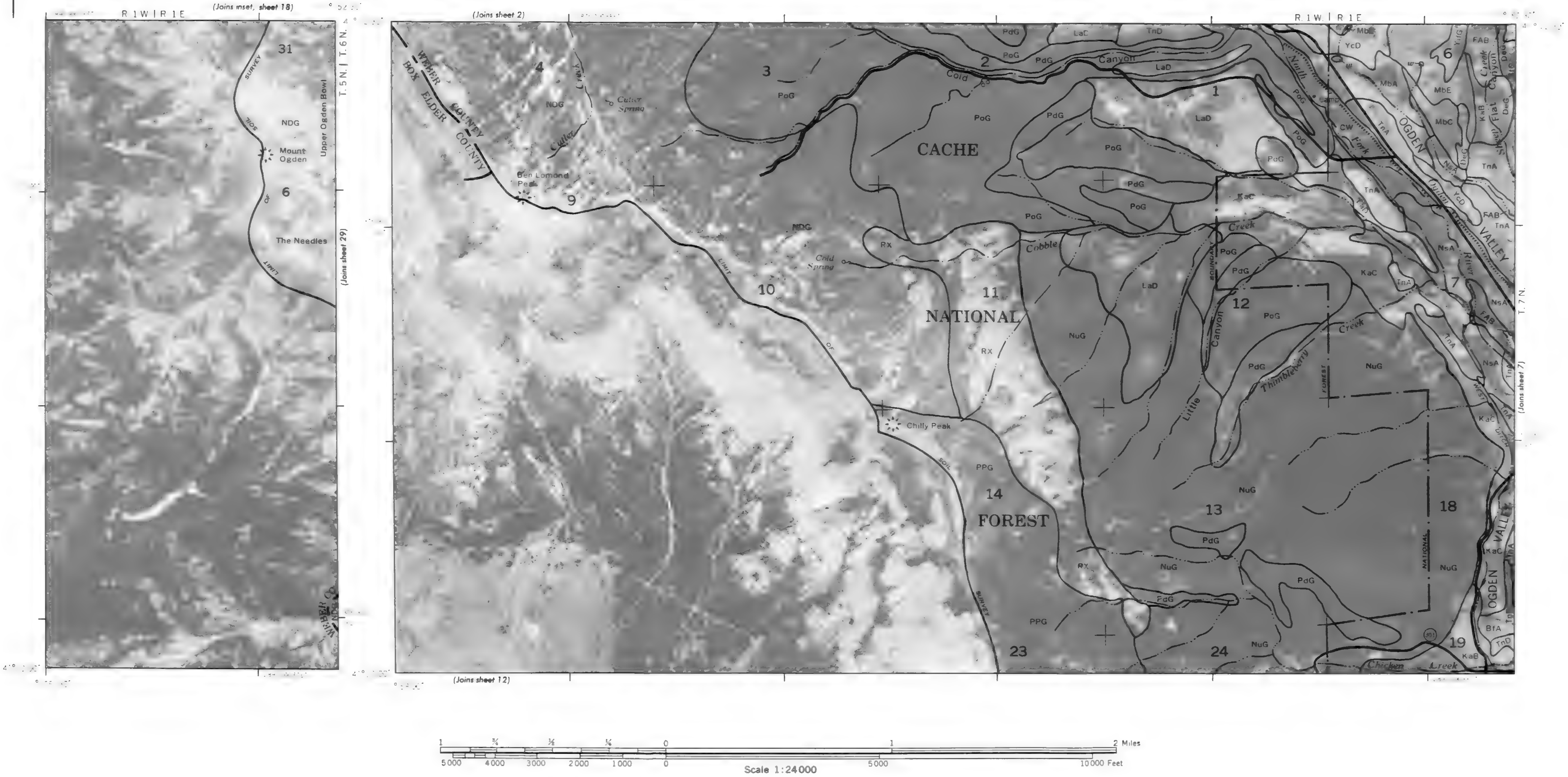


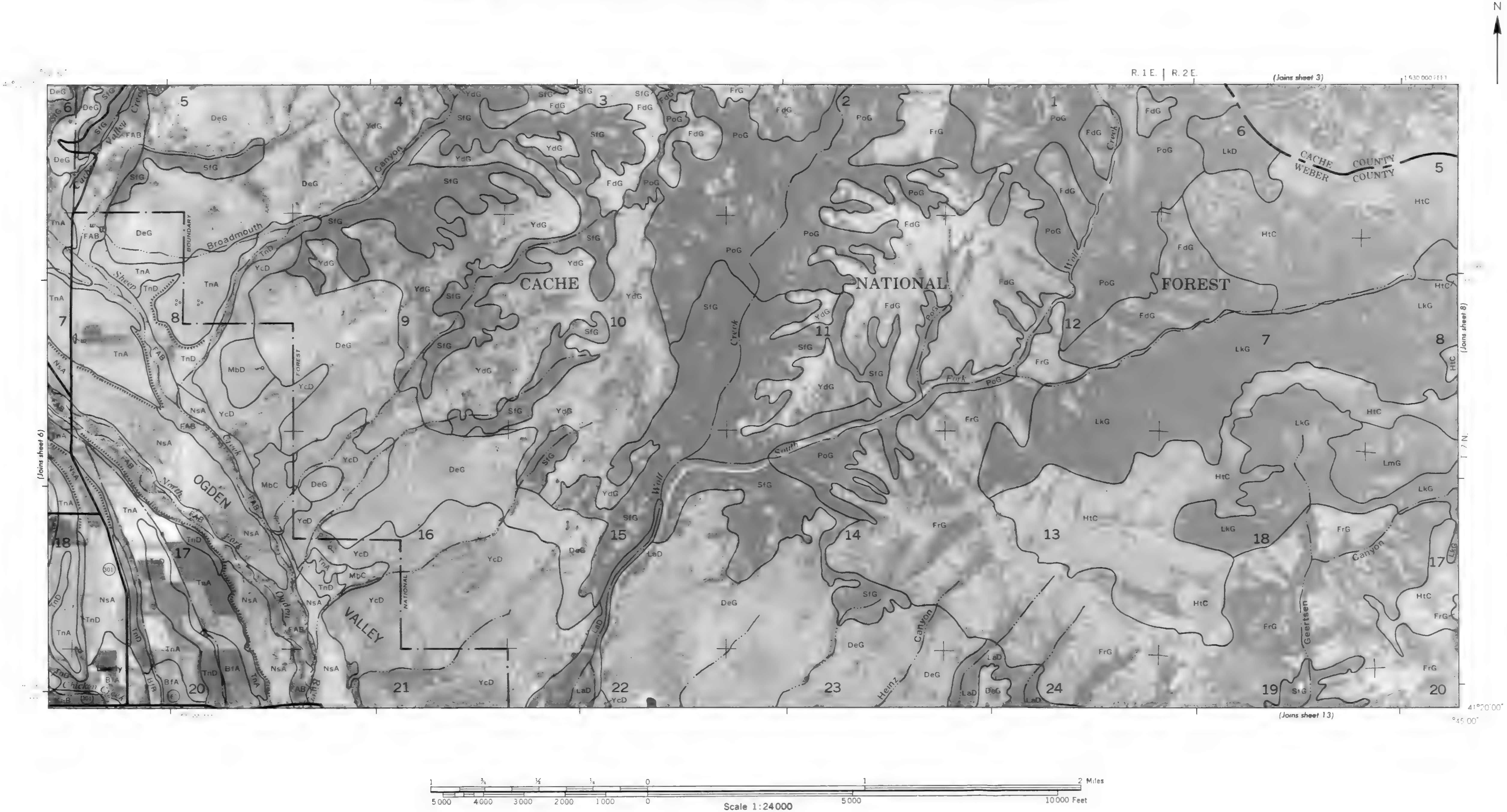
1 ¾ ½ ¼ 0 1 2 Miles

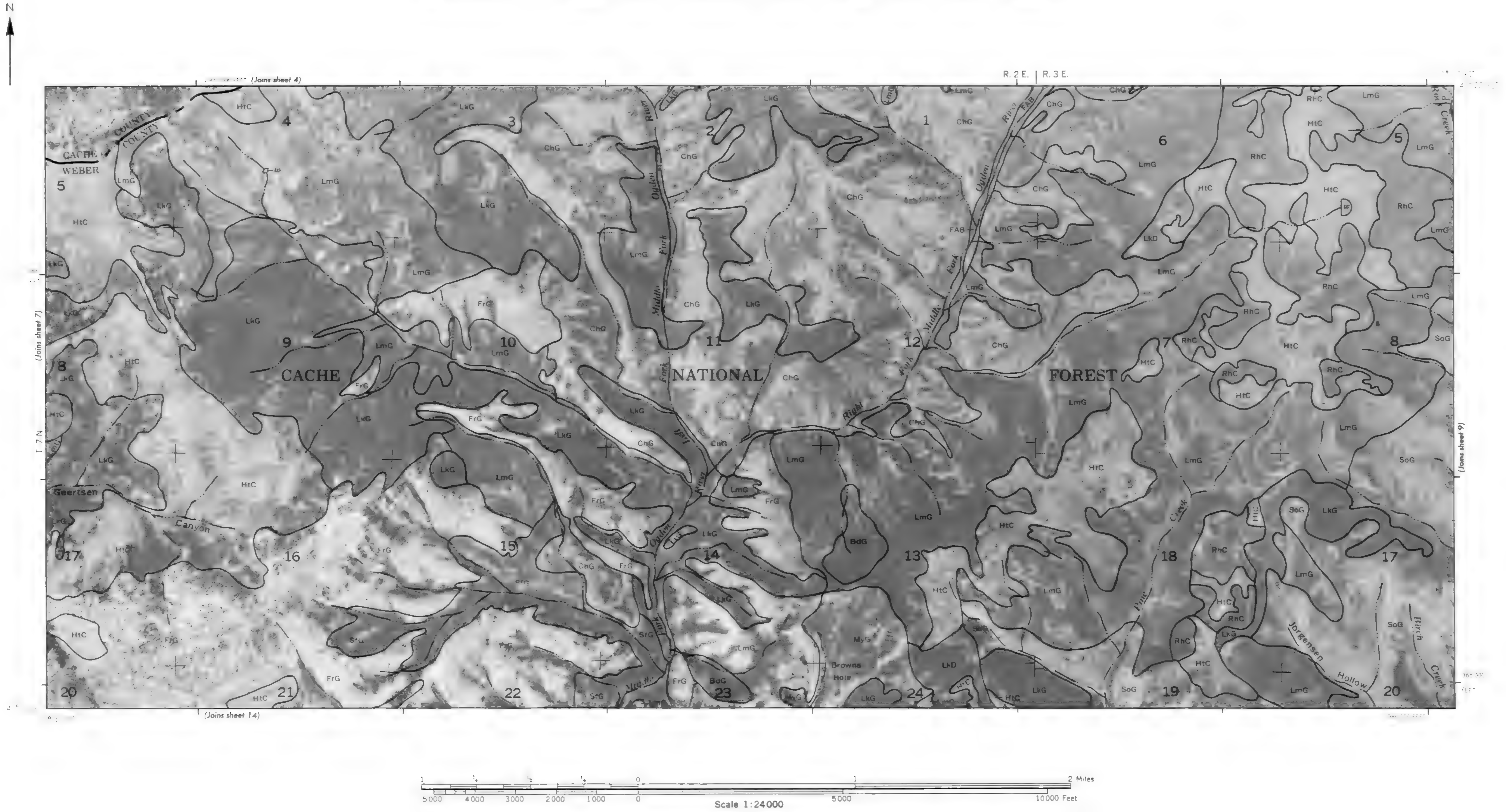
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 6

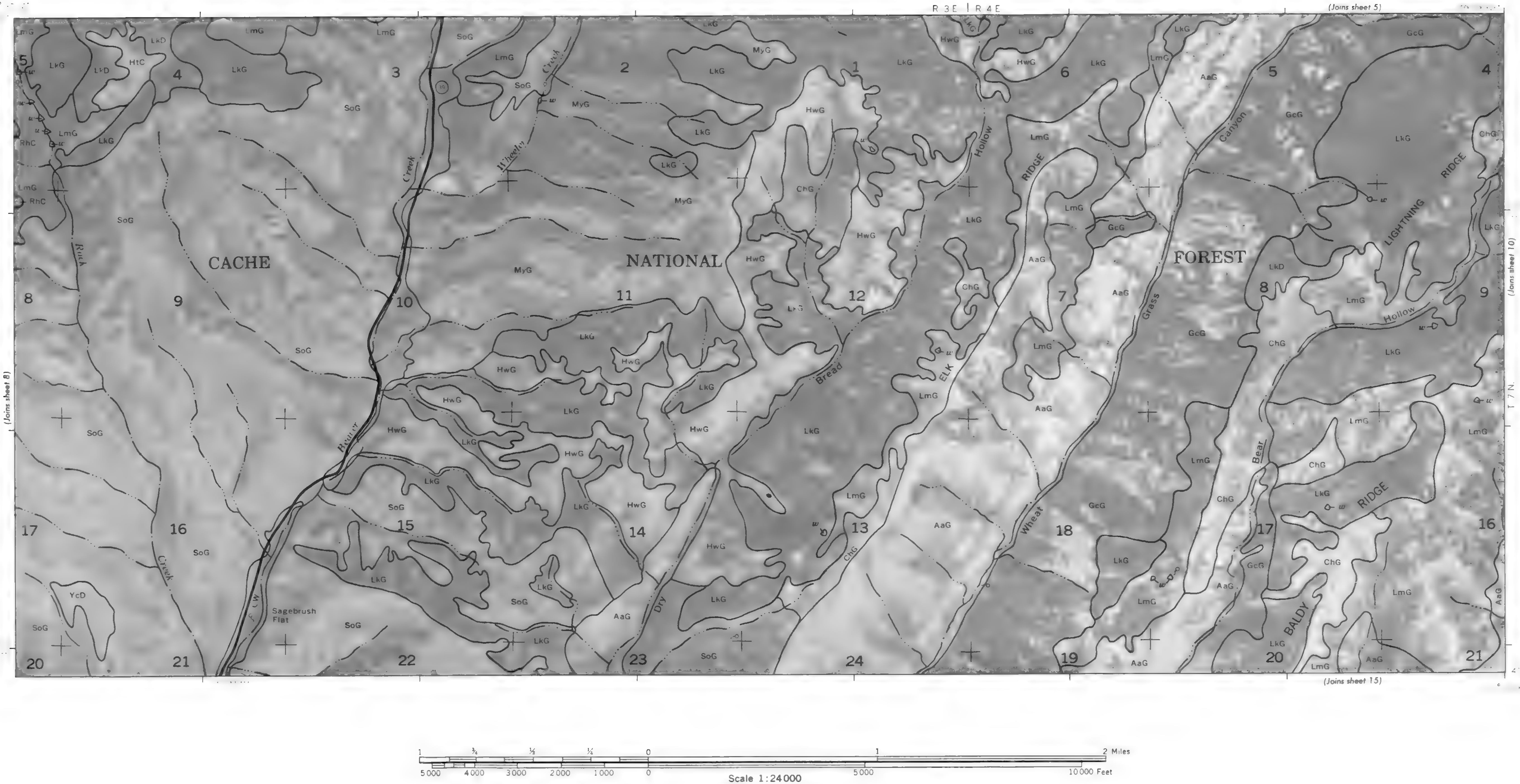



7
N
R. 1 E. | R. 2 E.
(Joins sheet 3)
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 13)
CACHE NATIONAL FOREST
CACHE COUNTY
WEBER COUNTY
OGDEN VALLEY
FOREST BOUNDARY
NATIONAL
Broadmouth
Sheep Creek
North Fork
South Fork
Wolf Creek
Heinz Canyon
Geertsen Canyon
Chicken Creek
Cache Valley Canyon
41°20'00"
1 ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000


N
(Joins sheet 4)
R. 2 E. | R. 3 E.
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 14)
T. 7 N.
CACHE COUNTY
WEBER COUNTY
CACHE
NATIONAL
FOREST
Geertsen
Canyon
Ogden
Middle
Fork
Left
Fork
Right
Fork
River
Pine
Creek
Birch
Creek
Jorgensen
Hollow
Browns
Hole
HtC
LkG
ChG
LmG
FrG
RhC
SoG
LkD
BdG
MyG
SfG
FAB
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
2 Miles
5000
4000
3000
2000
1000
0
10000 Feet
Scale 1:24000

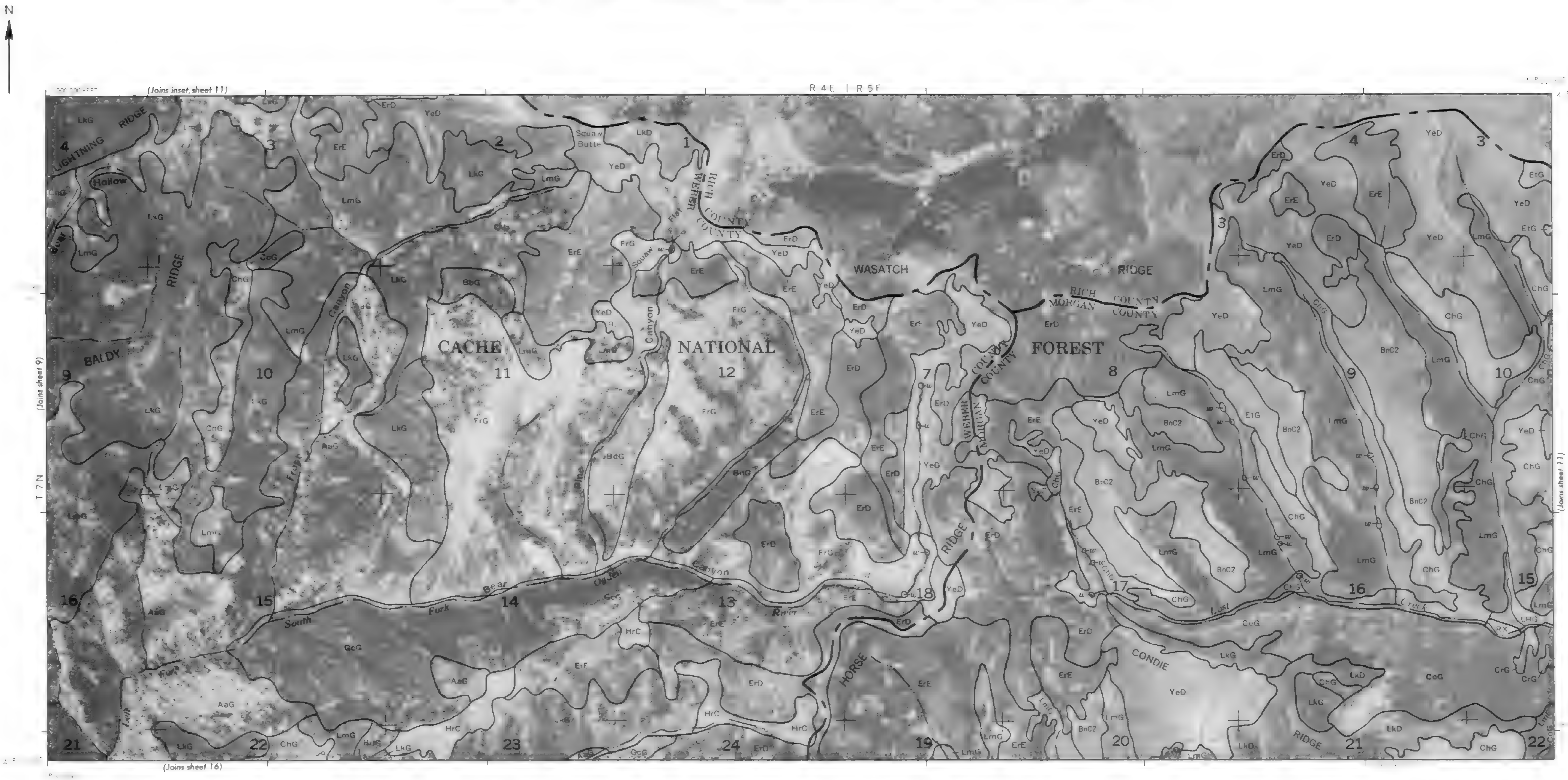
9

N



Scale 1:24000

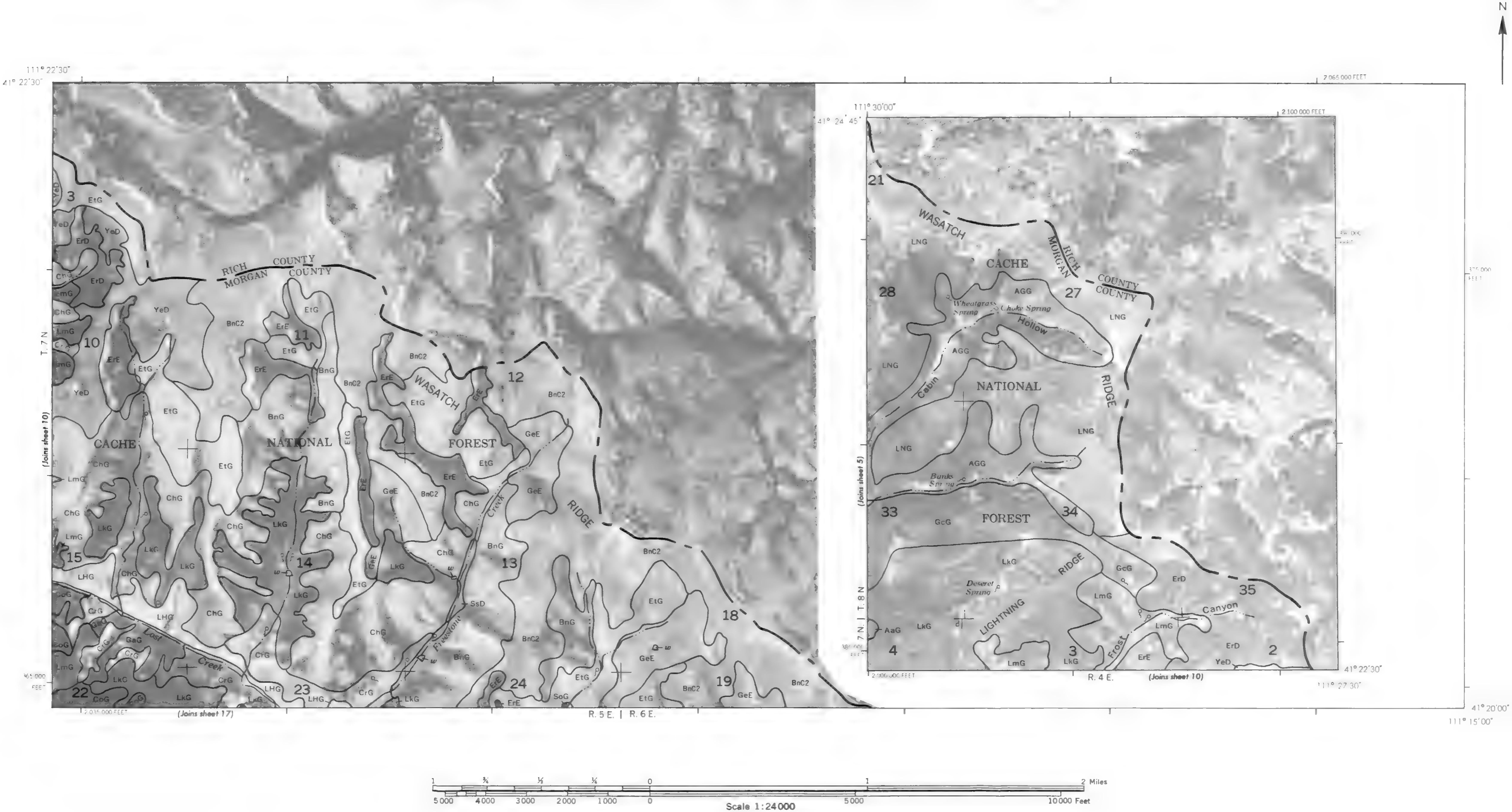
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 10



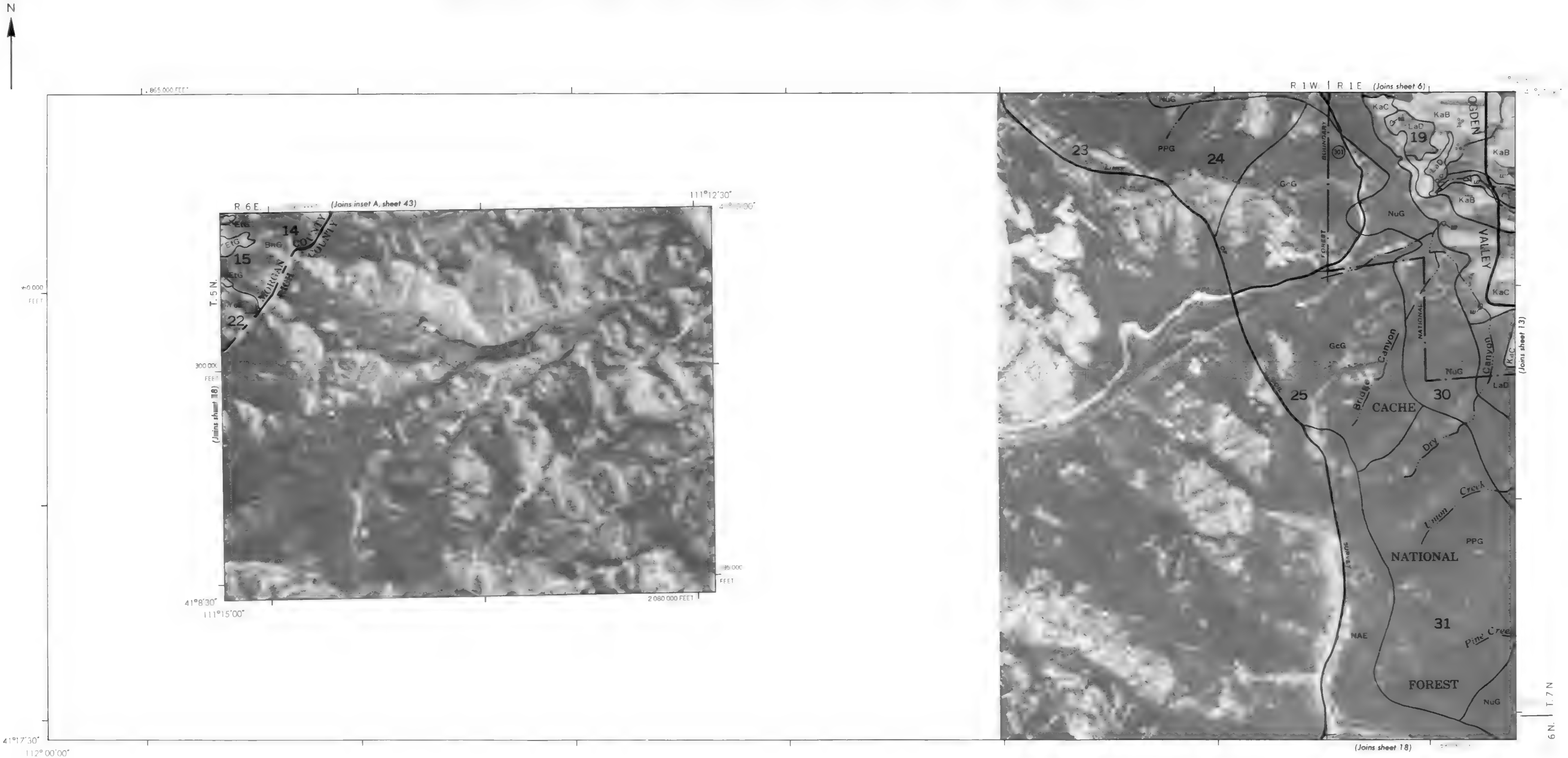
Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet


N
111° 22'30"
41° 22'30"
2 065 000 FEET
T. 7 N.
(Joins sheet 10)
RICH COUNTY
MORGAN COUNTY
CACHE
NATIONAL
FOREST
WASATCH
RIDGE
Lost Creek
Freestone Creek
365 000 FEET
2 035 000 FEET
(Joins sheet 17)
R. 5 E. | R. 6 E.
111° 30'00"
41° 24'45"
2 100 000 FEET
WASATCH
RICH
MORGAN
COUNTY
COUNTY
CACHE
NATIONAL
FOREST
RIDGE
Wheatgrass Spring
Choke Spring
Hollow
Cabin
Banks Spring
Deseret Spring
LIGHTNING RIDGE
Frost Canyon
(Joins sheet 5)
T. 8 N.
T. 7 N.
R. 4 E.
(Joins sheet 10)
2 090 000 FEET
41° 22'30"
111° 27'30"
41° 20'00"
111° 15'00"
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

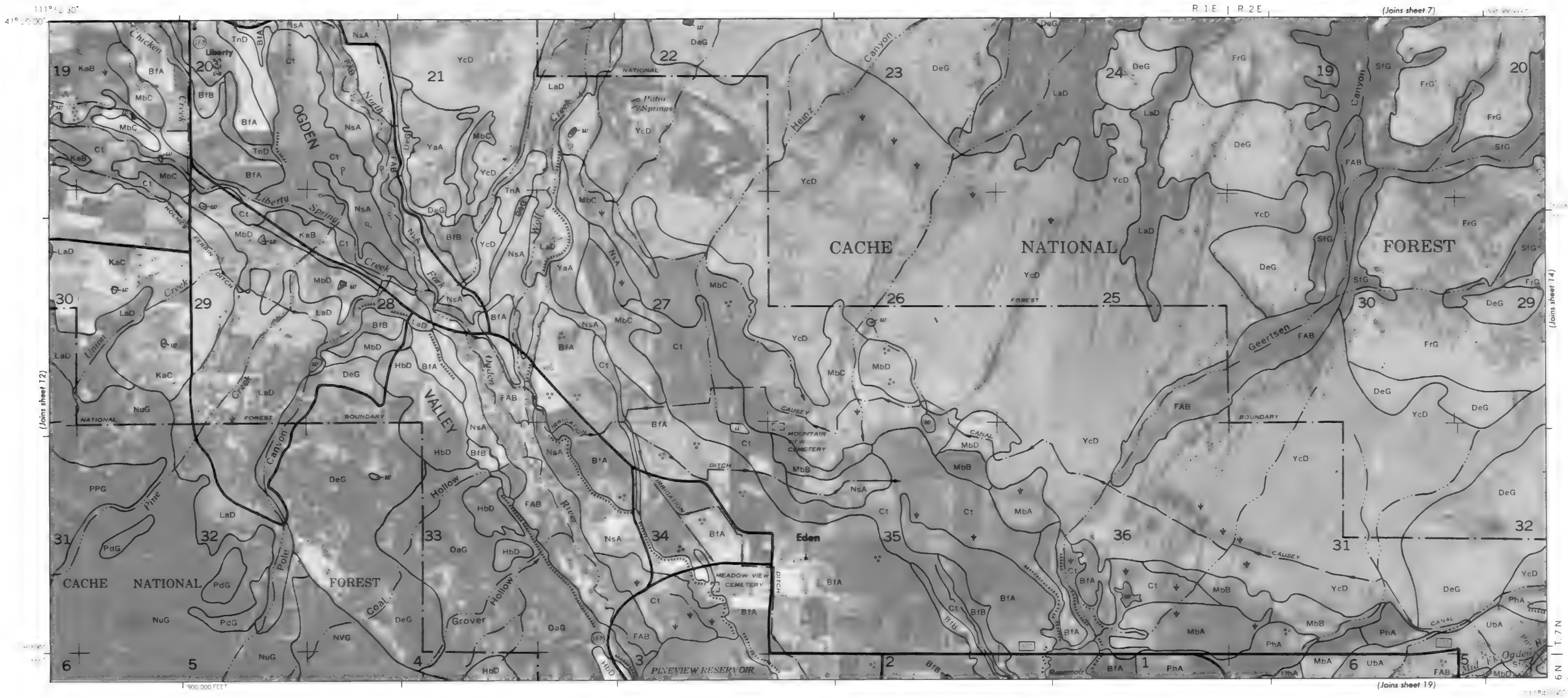
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 12



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

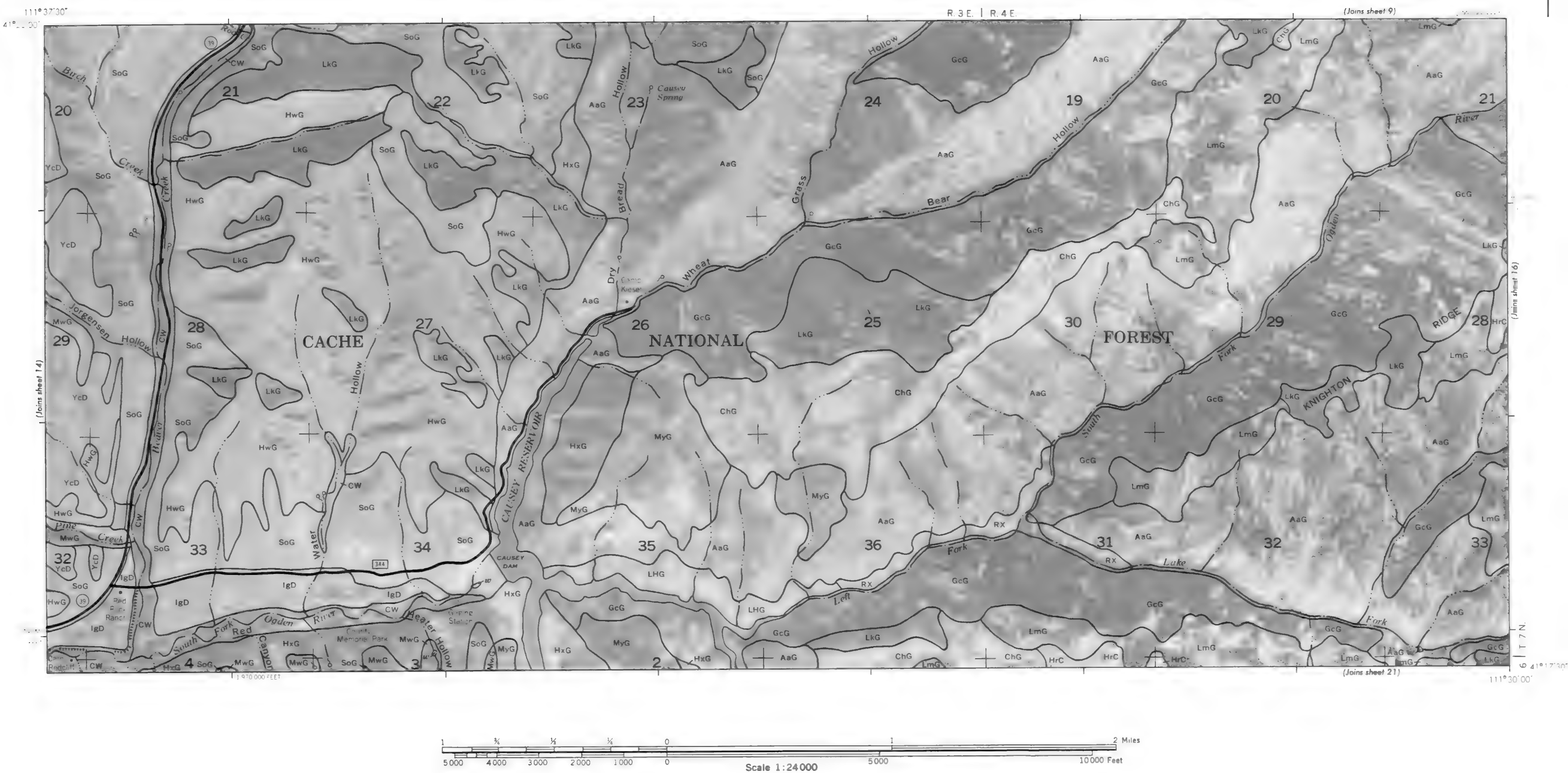
5000 4000 3000 2000 1000 0 5000 10000 Feet

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 14

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000


N
111°37'30"
R.3 E. | R.4 E.
(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 21)
111°30'00"
T.7 N.
CACHE
NATIONAL
FOREST
CAUSEY RESERVOIR
CAUSEY DAM
Causey Spring
Camp Kiesel
Bear Hollow
Wheat Grass Hollow
Dry Bread Hollow
Birch Creek
Beaver Creek
Jorgensen Hollow
Pine Creek
Water Hollow
South Fork Ogden River
Red Canyon
Heater Hollow
Left Fork
South Fork
Lake Fork
KNIGHTON RIDGE
Ogden River
County Memorial Park
Red Rock Ranch
1 970 000 FEET
Scale 1:24000
2 Miles
10000 Feet

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 16

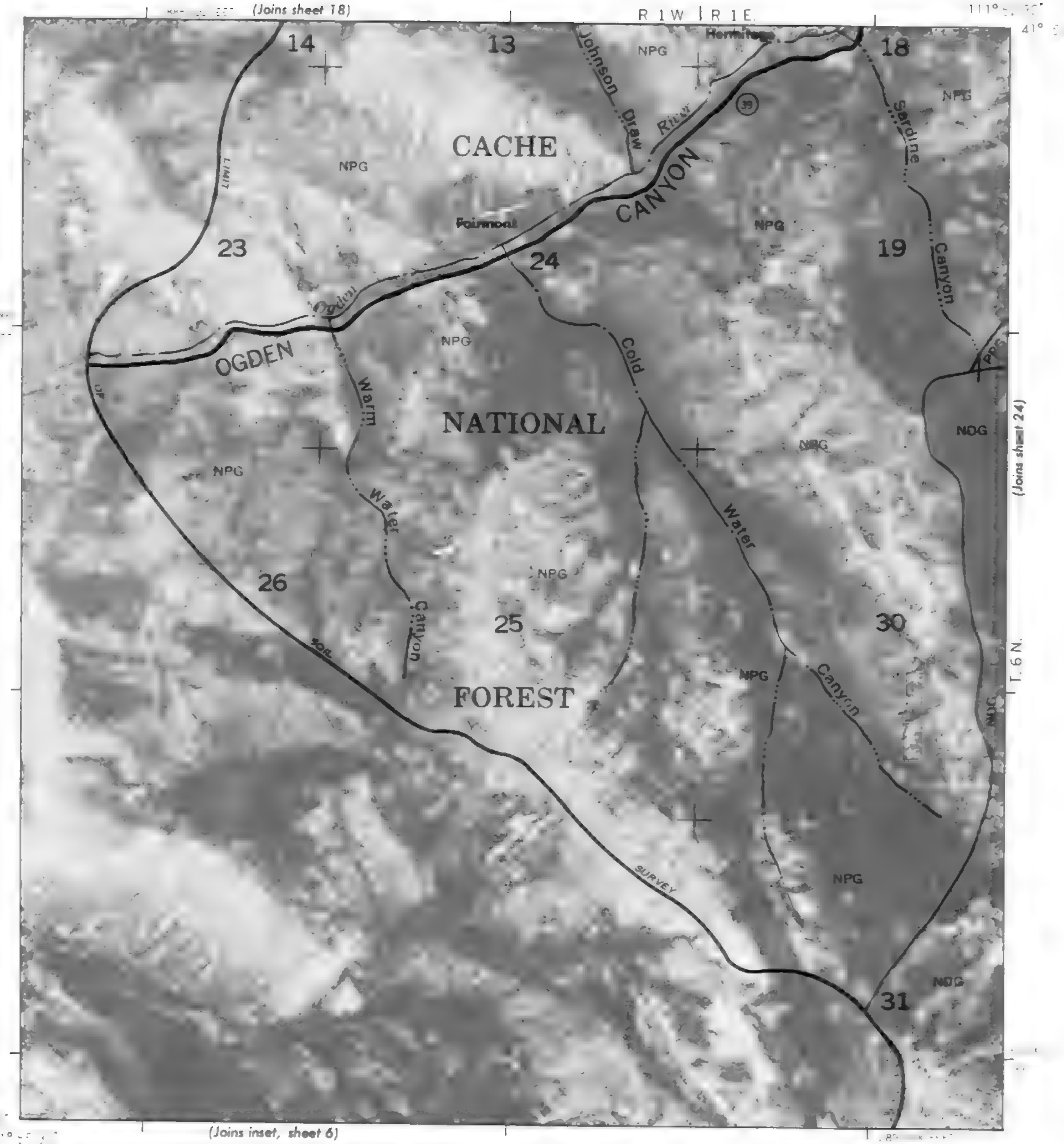
Scale 1:24000

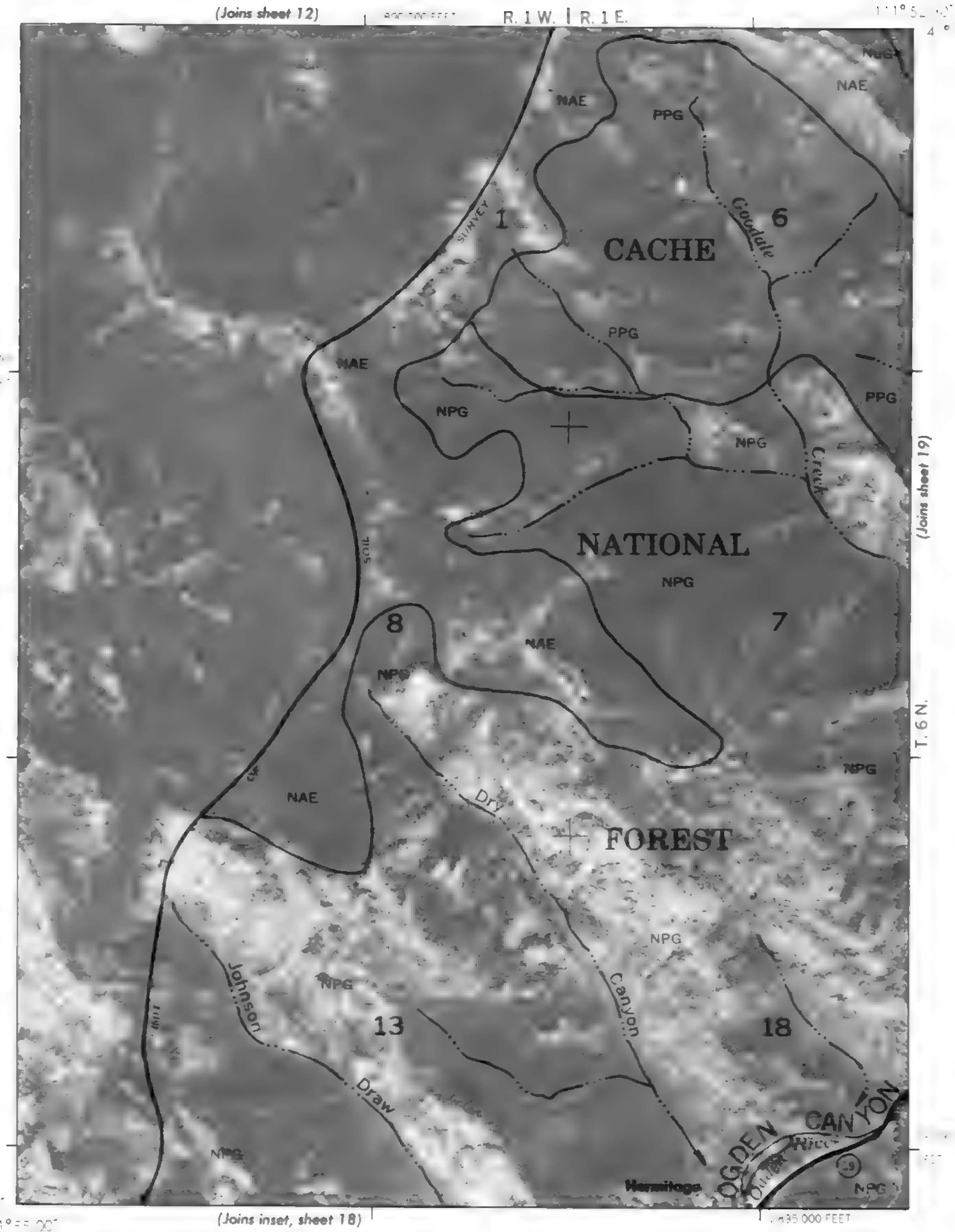
N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



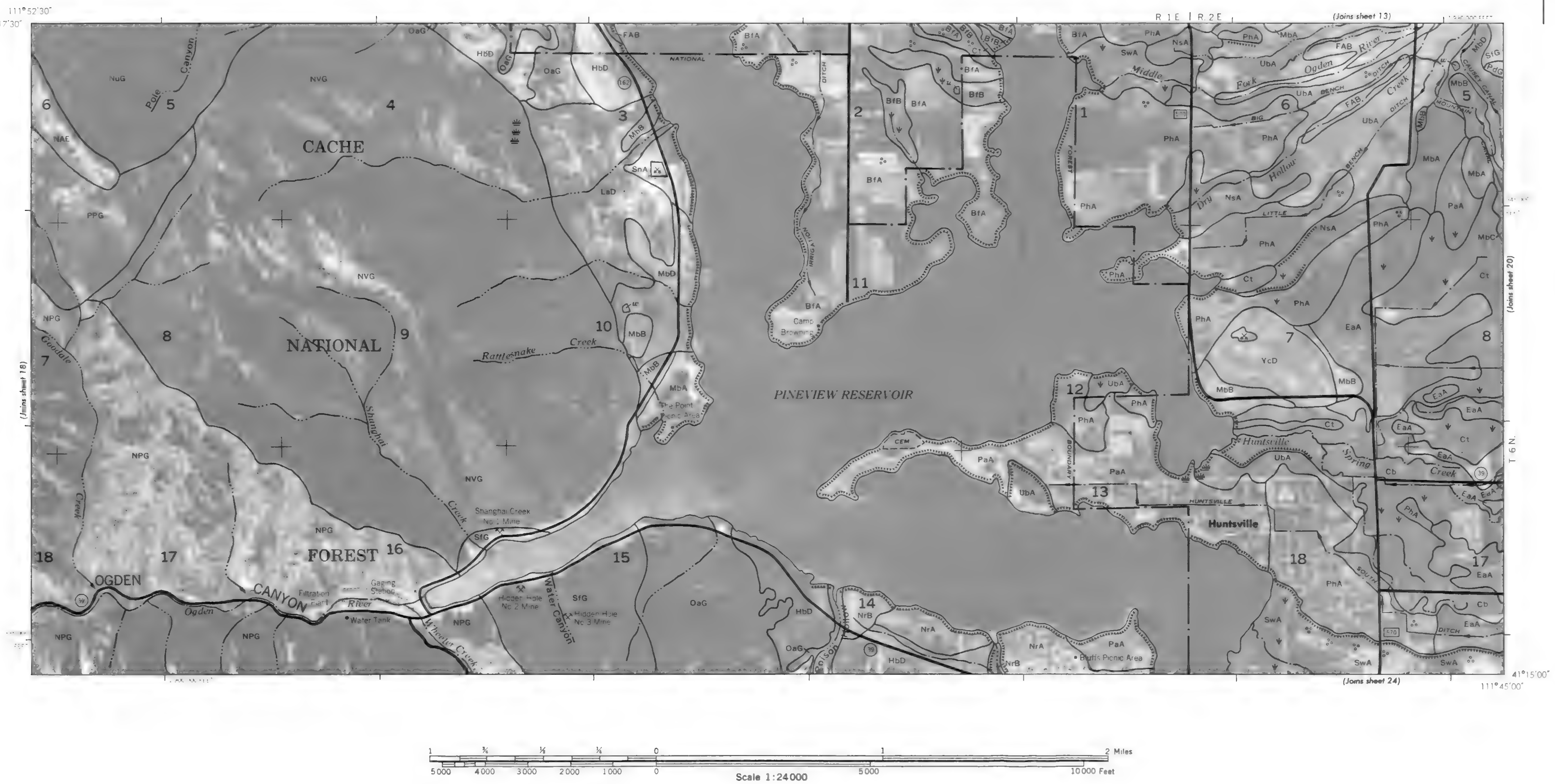


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

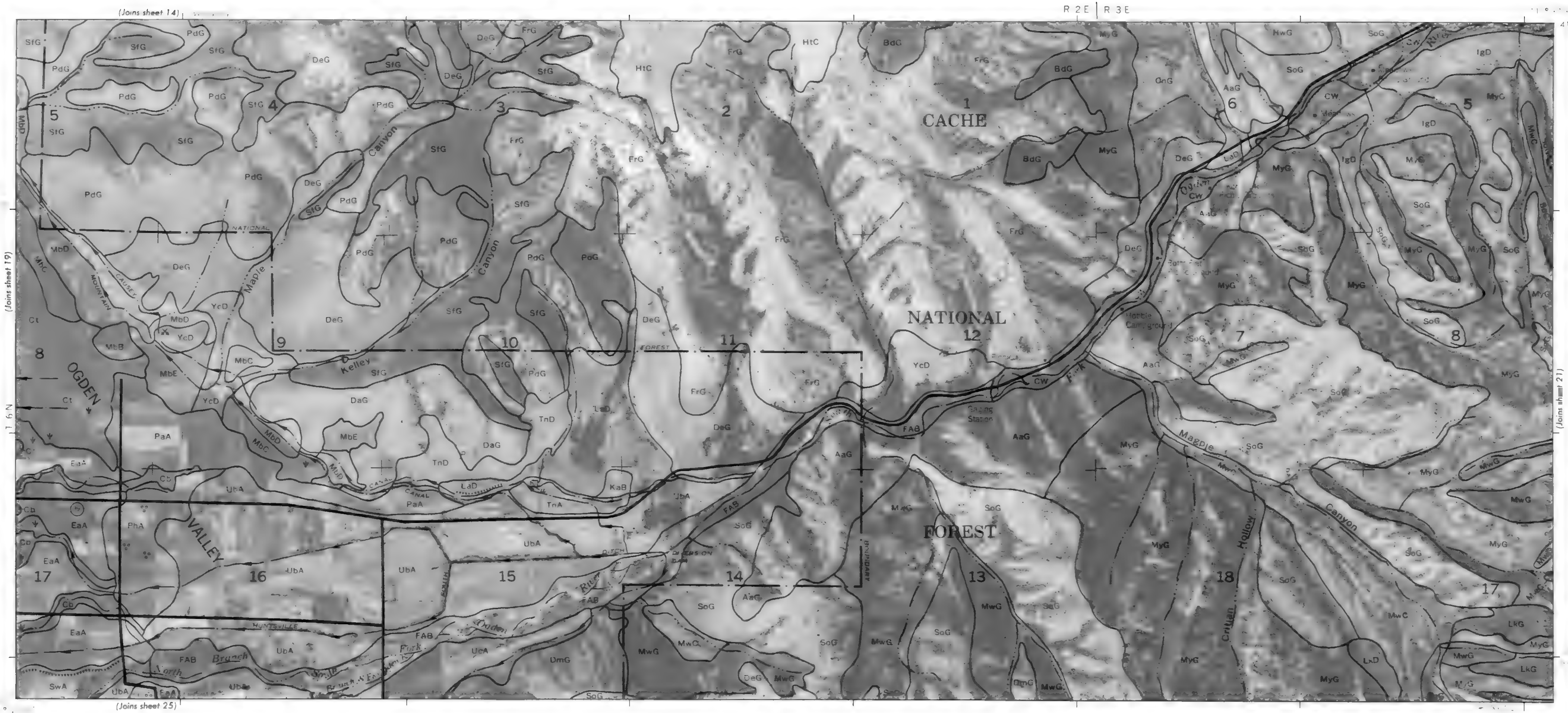
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 19



N

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 20



1 ½ ¼ 0 1 2 Miles

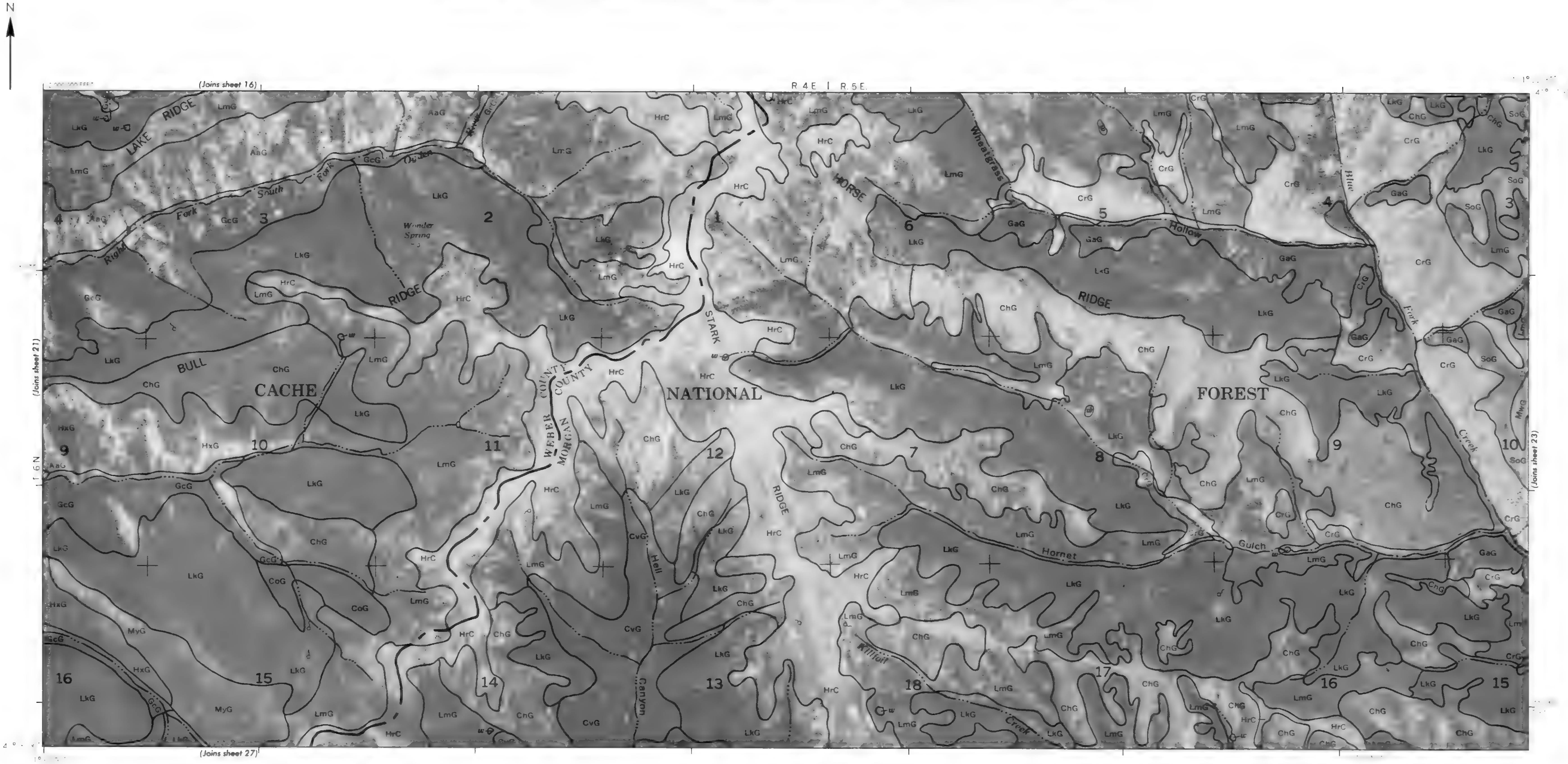
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

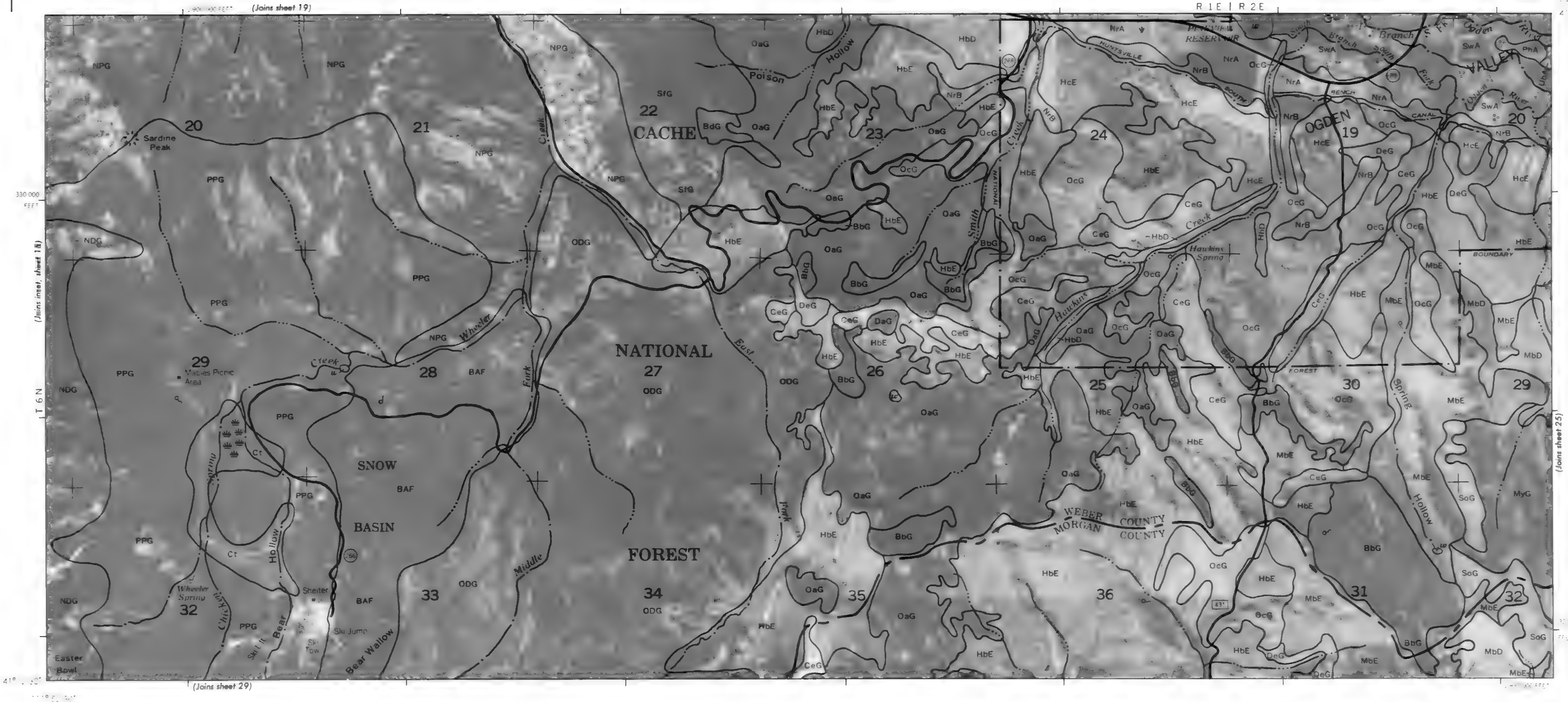
N

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

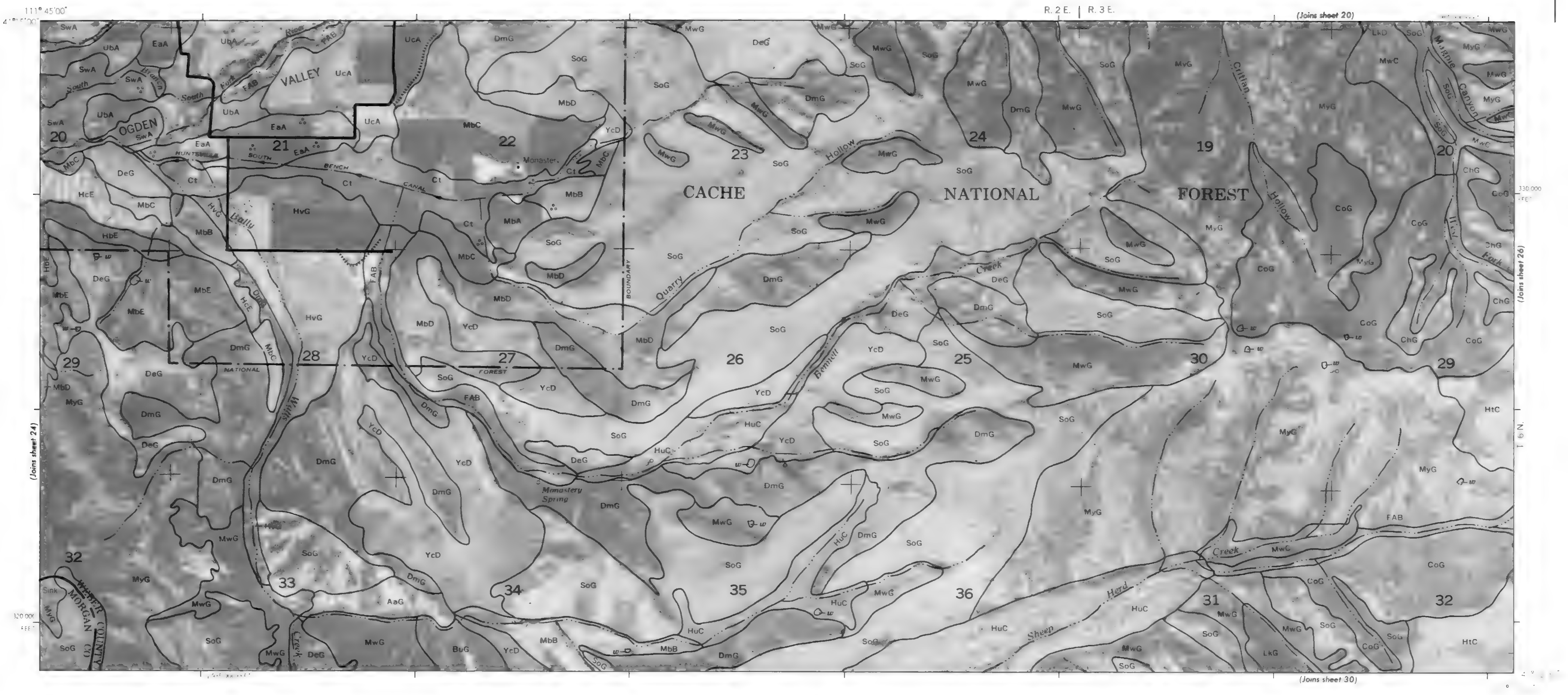
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 24



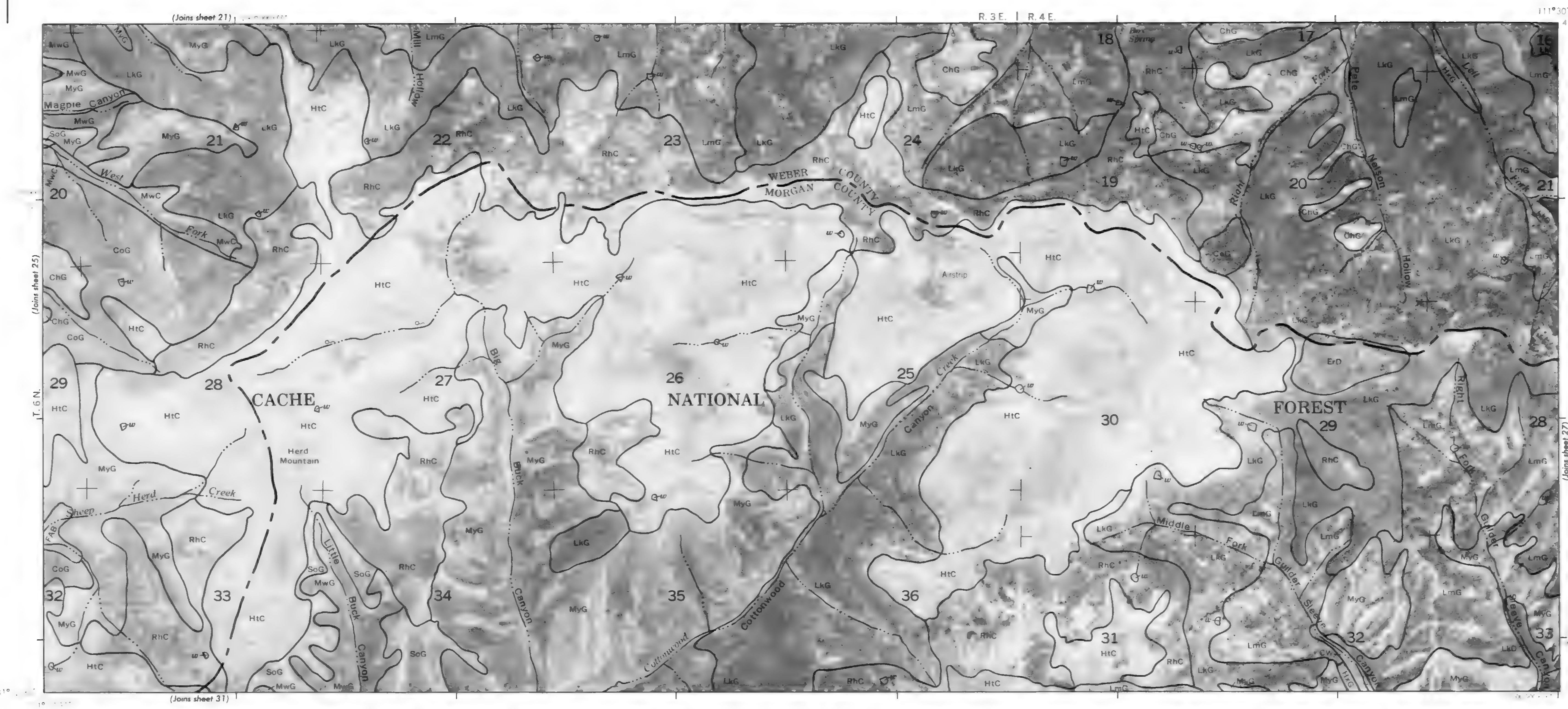
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000



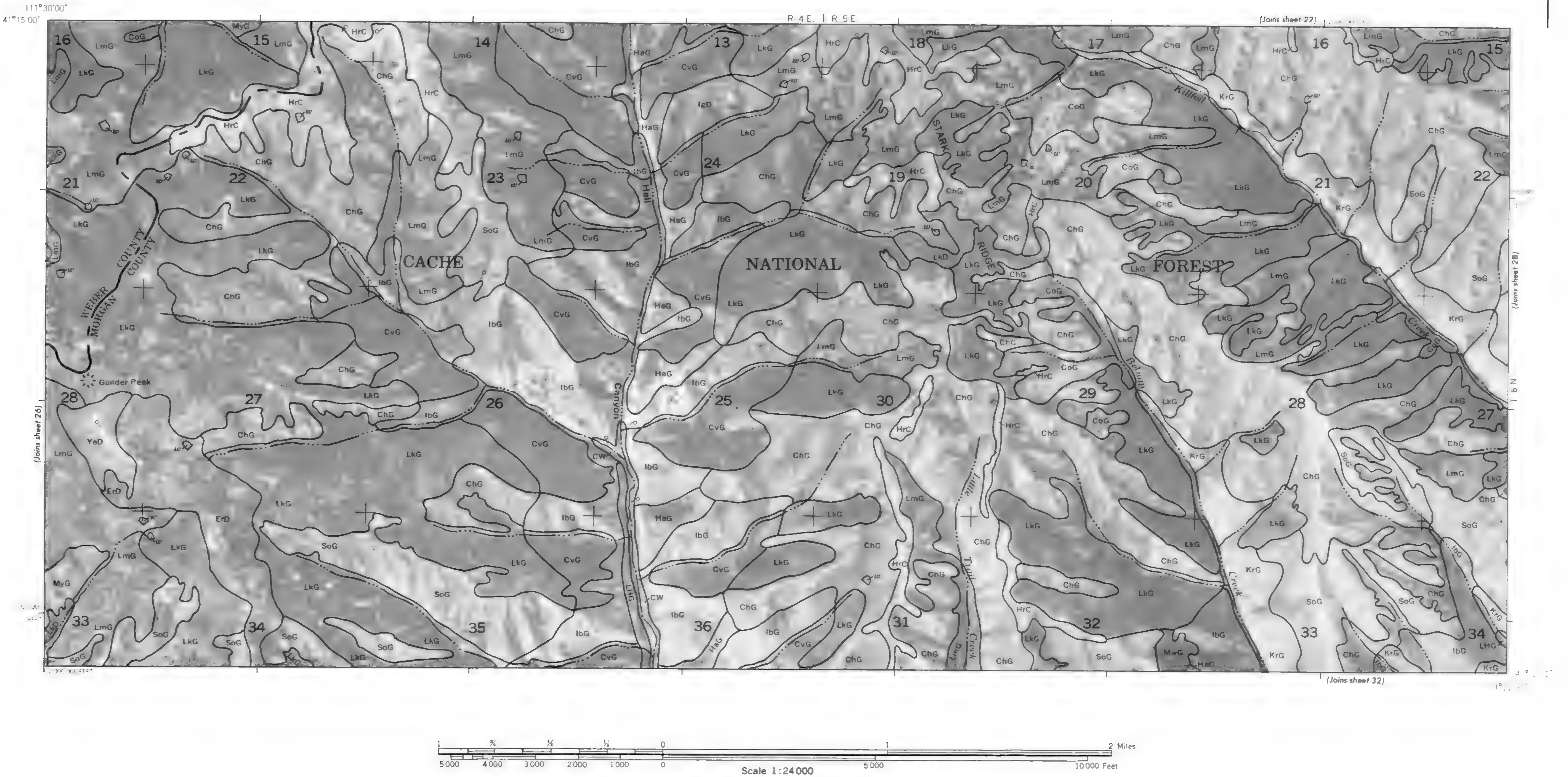
Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet



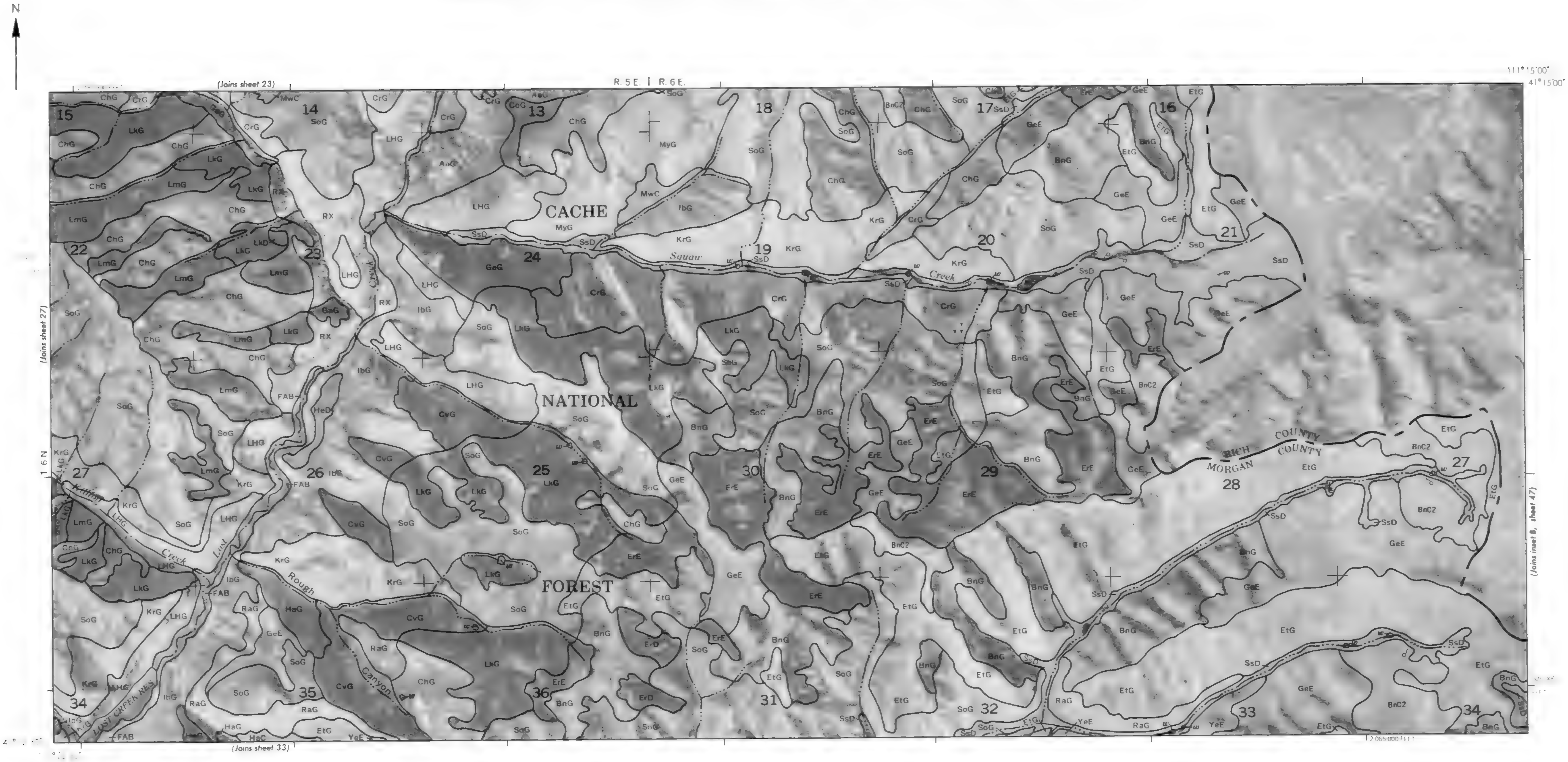
1 ¾ ½ ¼ 0 1 2 Miles

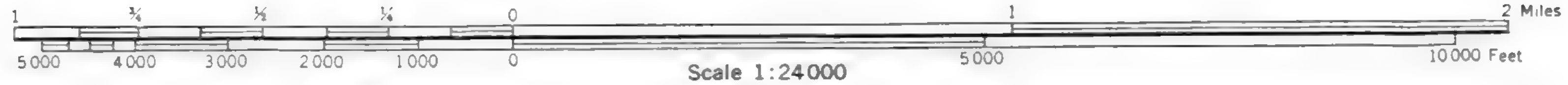
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

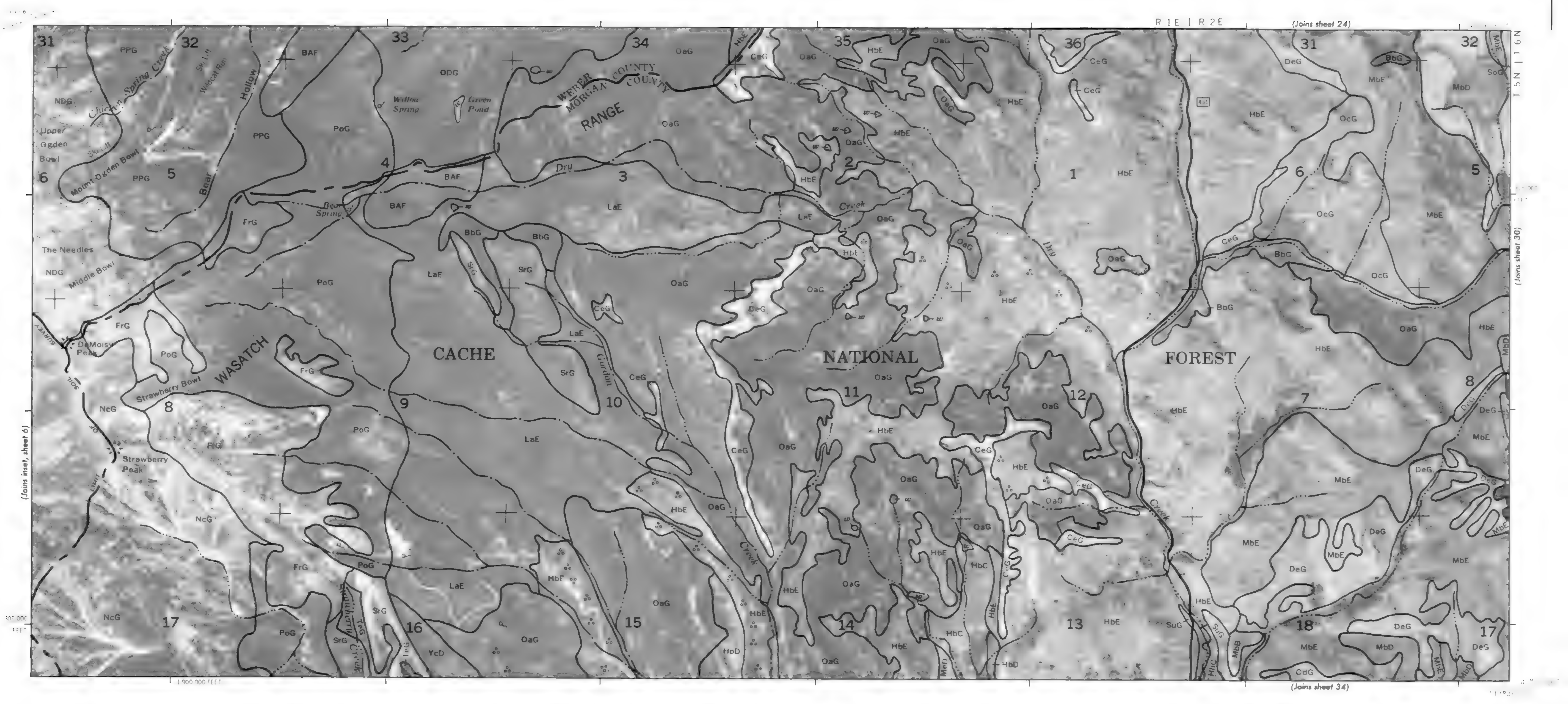

27
N
111°30'00"
41°15'00"
R.4E. | R.5E.
(Joins sheet 22)
(Joins sheet 28)
(Joins sheet 26)
(Joins sheet 32)
T.6N.
CACHE
NATIONAL
FOREST
WEBER COUNTY
MORGAN COUNTY
Guilder Peak
Hell Canyon
STARK RIDGE
Killfoil Creek
Bellum Creek
Little Trail Creek
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 28





Scale 1:24000



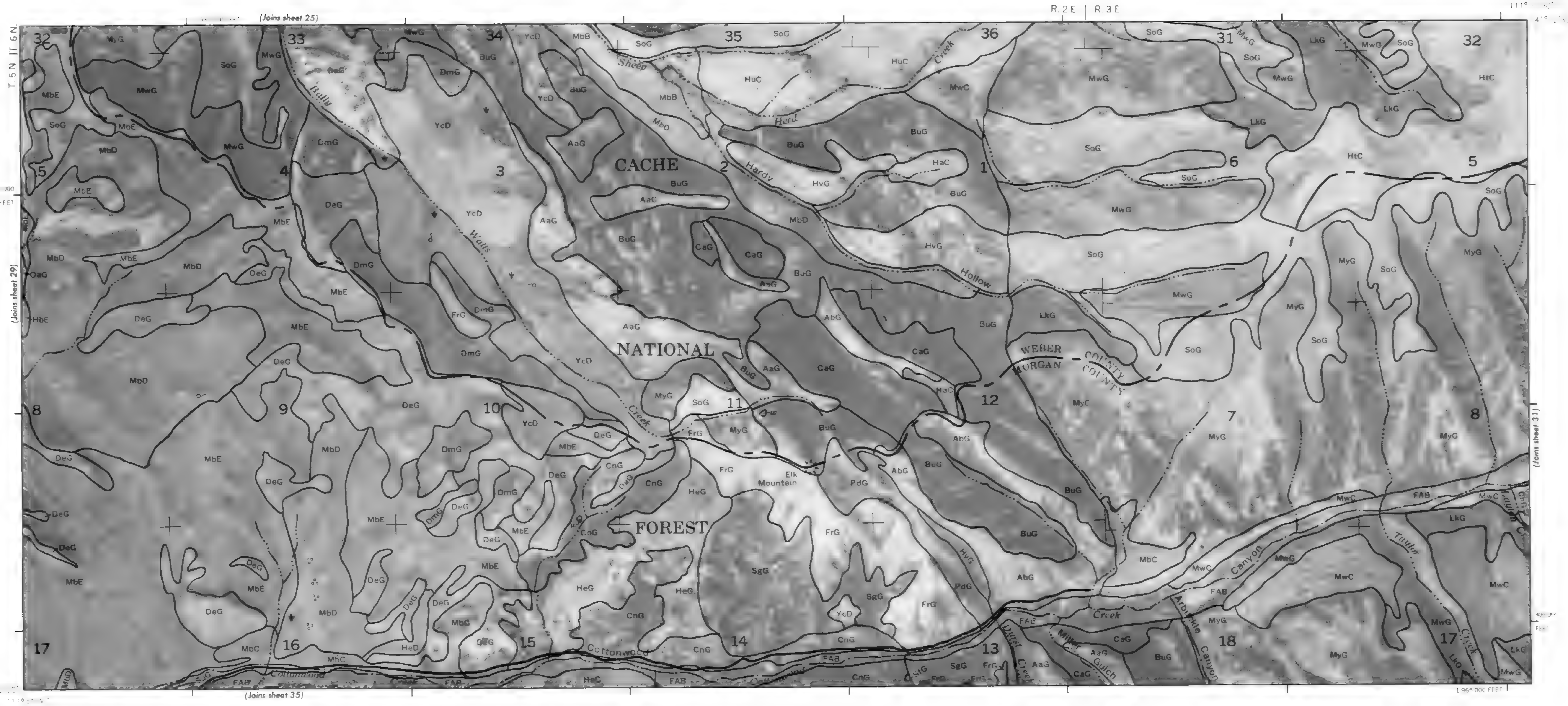
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

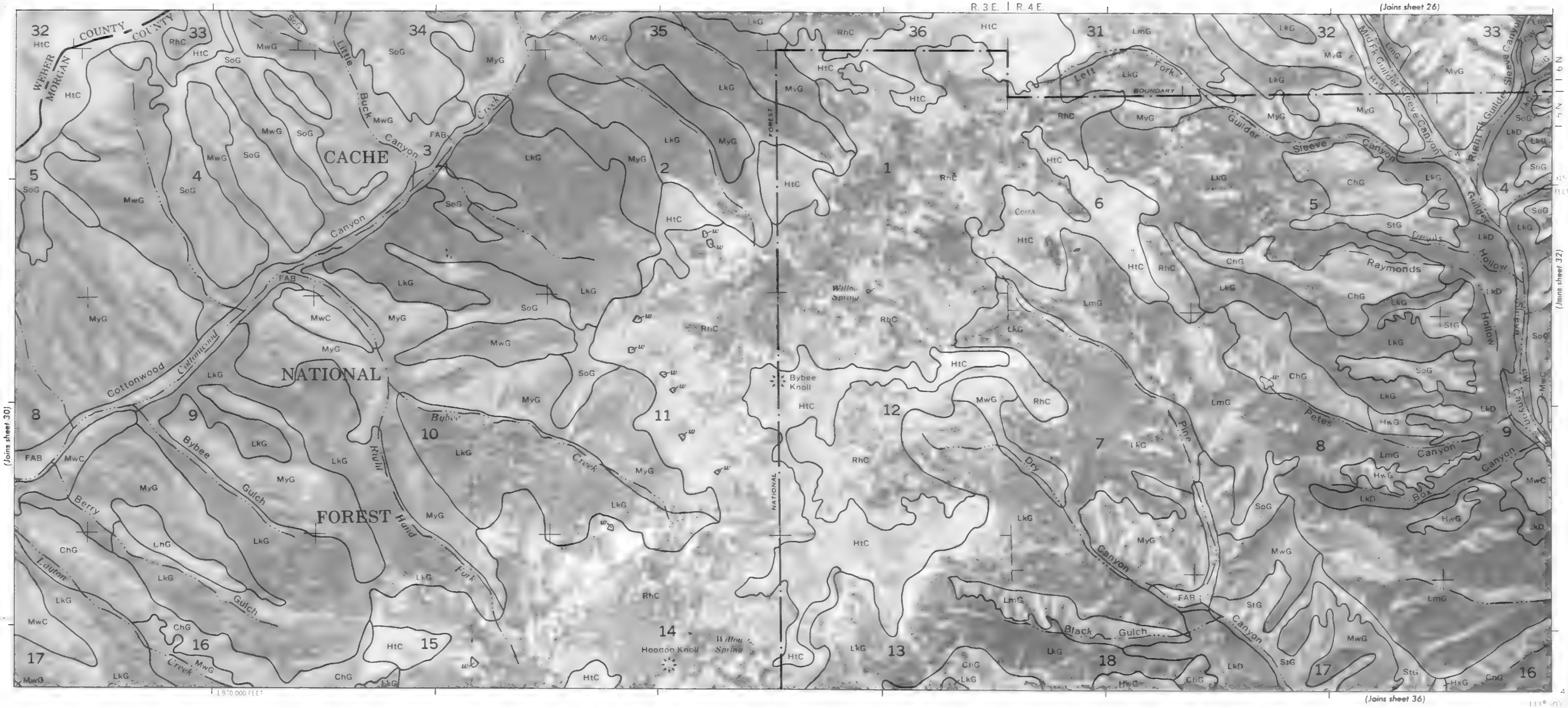
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 30



1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

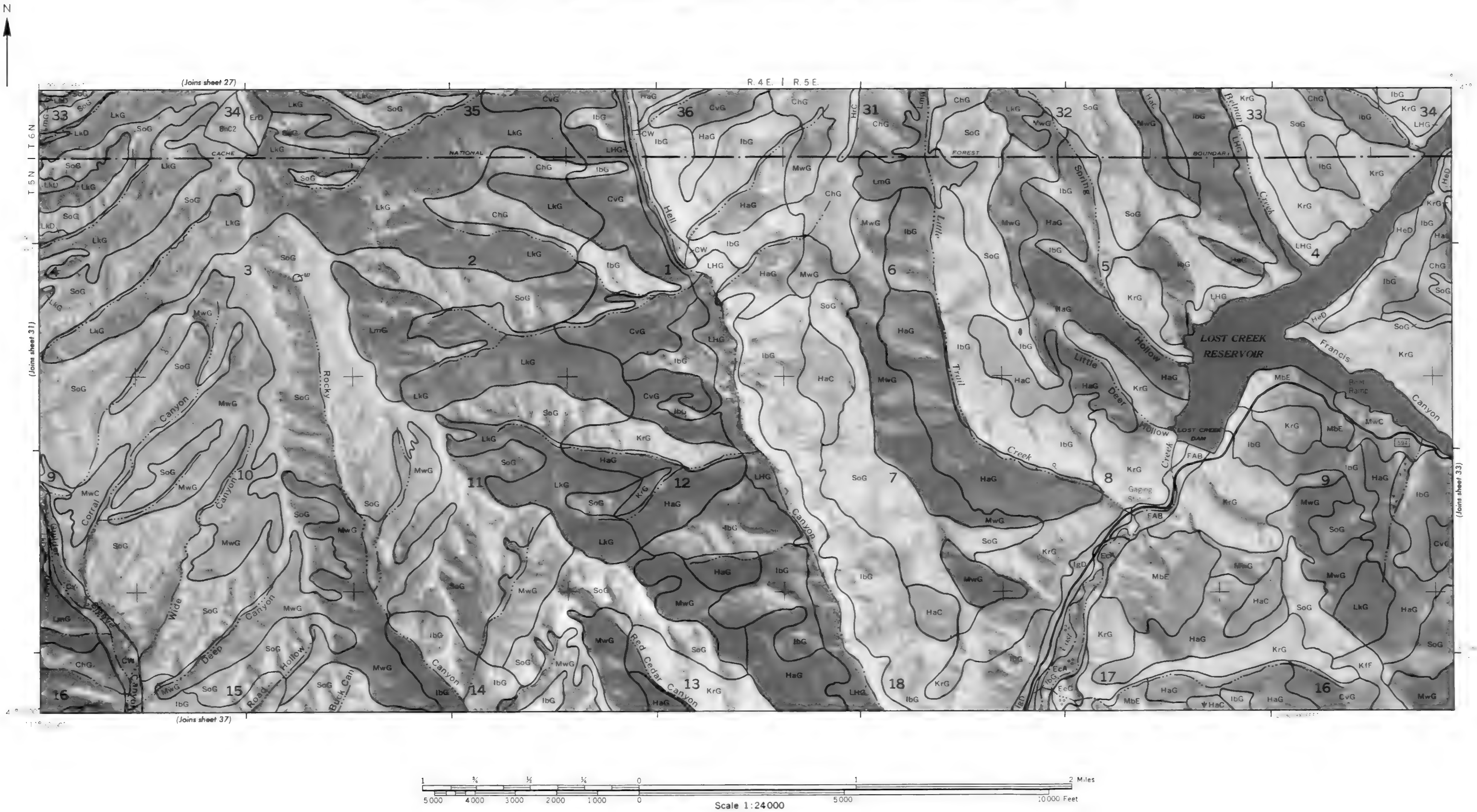
Scale 1:24000

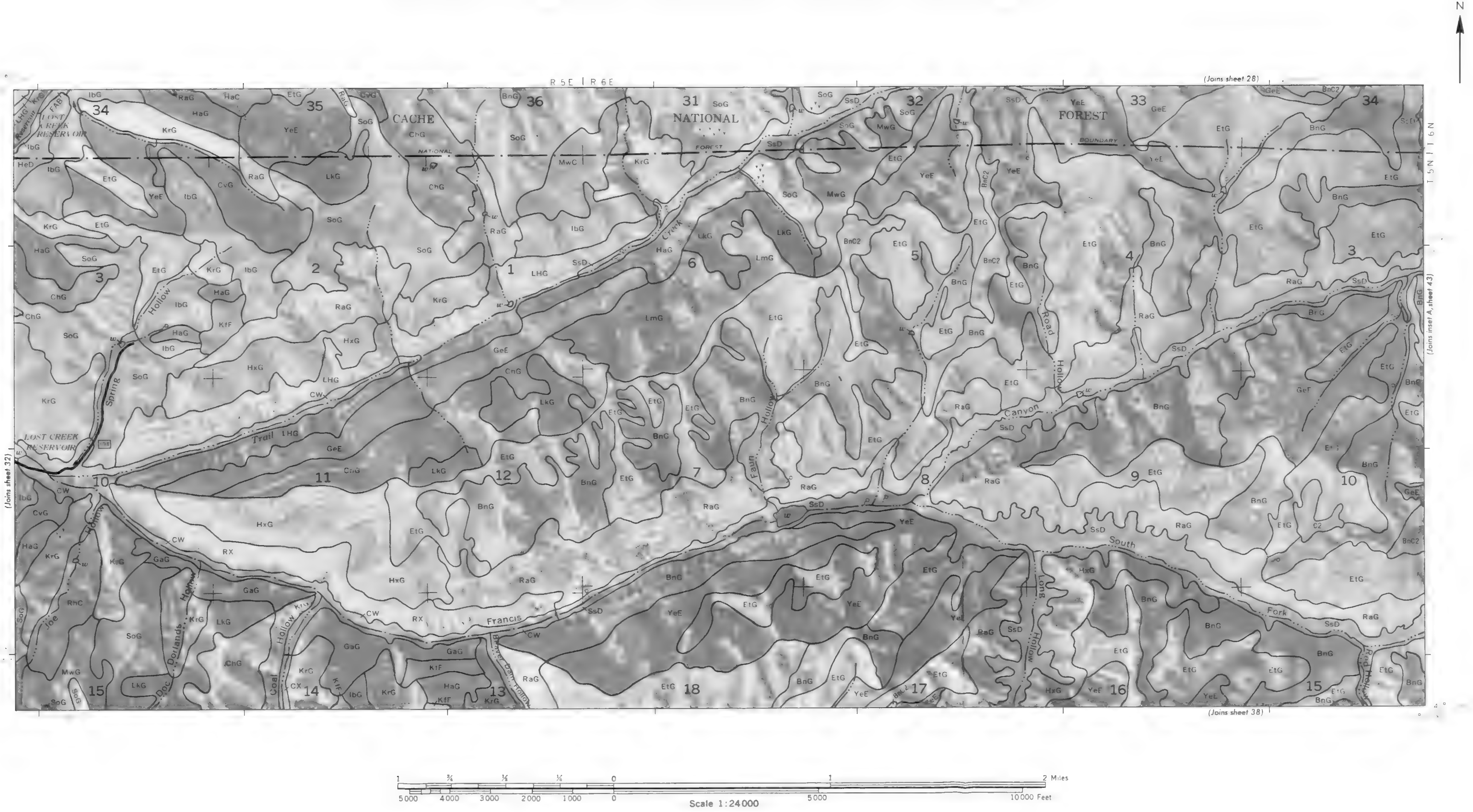


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

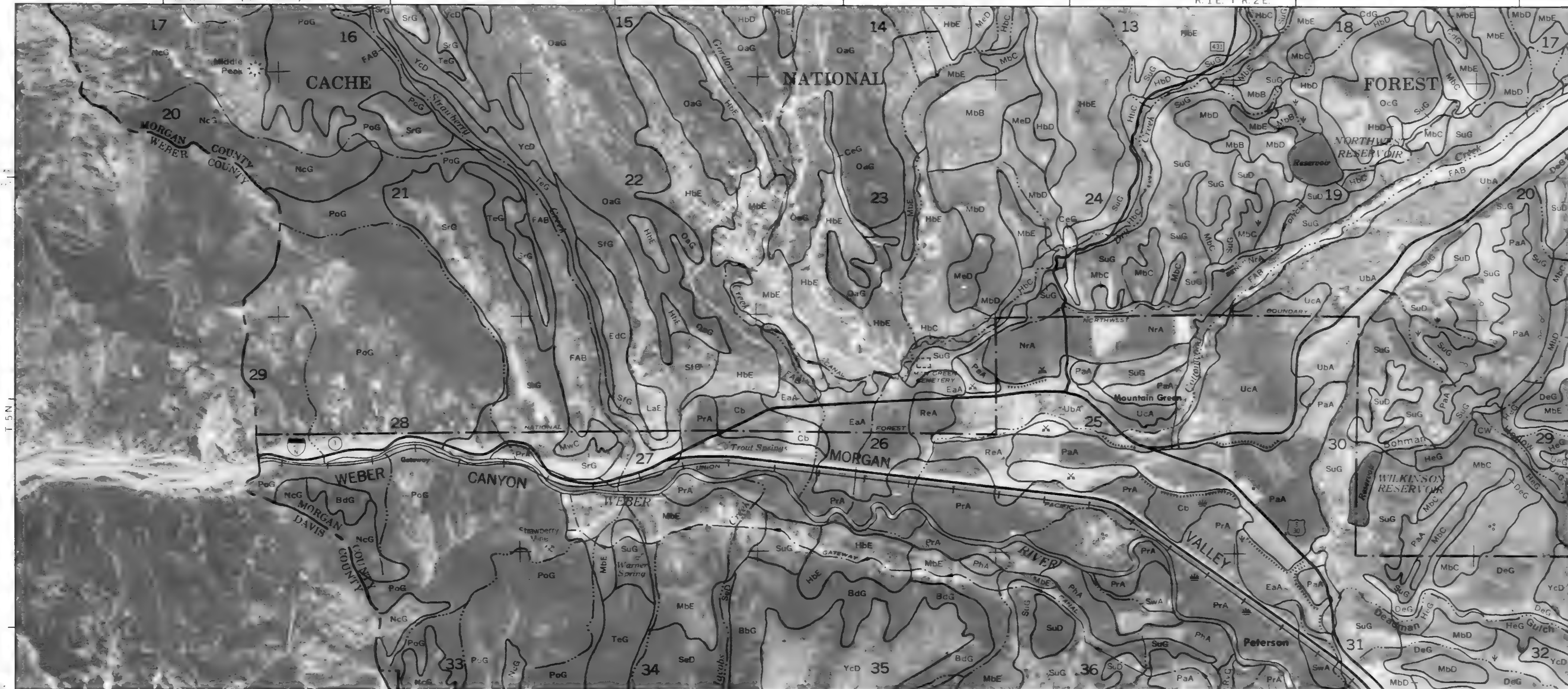
Scale 1:24000


N
(Joins sheet 27)
R. 4 E. | R. 5 E.
T 6 N
T 5 N
CACHE
NATIONAL
FOREST
BOUNDARY
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 37)
LOST CREEK RESERVOIR
LOST CREEK DAM
Boat Ramp
Gaging Station
Hell Canyon
Rocky
Canyon
Corral Canyon
Wide Canyon
Deep Canyon
Hollow Road
Buck Can
Red Cedar Canyon
Little Trail Creek
Spring Hollow
Little Deer Hollow
Lost Creek
Francis Canyon
Belnap Creek
Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet


33
N
(Joins sheet 28)
(Joins sheet 32)
(Joins sheet 38)
(Joins inset A, sheet 43)
R 5 E | R 6 E
T 5 N | T 6 N
CACHE
NATIONAL
FOREST
NATIONAL FOREST BOUNDARY
LOST CREEK RESERVOIR
Spring Hollow
Trail
Creek
Canyon Road Hollow
Faun Hollow
Francis
South Fork
Long Hollow
Red Hollow
Joe Hollow
Doc Dorlands Hollow
Coal Hollow
Beaver Dam Hollow
Scale 1:24000
2 Miles
10000 Feet

N

(Joins sheet 29)

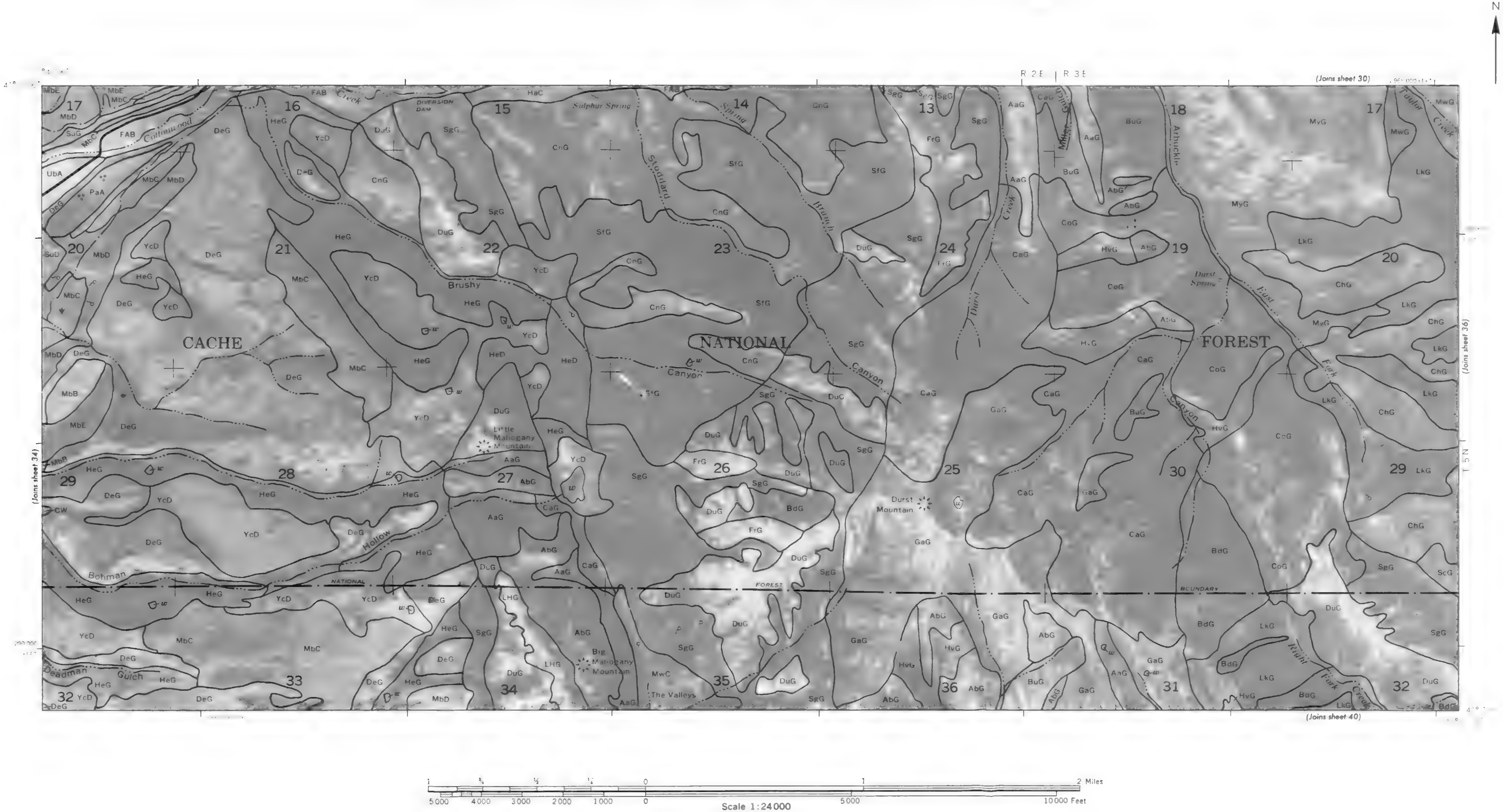


(Joins sheet 39)

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000


N
R 2 E | R 3 E
(Joins sheet 30)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 40)
T 5 N
CACHE
NATIONAL
FOREST
NATIONAL FOREST BOUNDARY
Cottonwood Creek
DIVERSION DAM
Sulphur Spring
Stoddard
Spring Branch
Brushy Canyon
Canyon
Little Mahogany Mountain
Durst Mountain
Durst Creek
Miller Gulch
Arbuckle
Durst Spring
East Fork Canyon
Taylor Creek
Hollow
Bohman
Deadman Gulch
Big Mahogany Mountain
The Valleys
Right Fork Creek
17
16
15
14
13
18
17
20
21
22
23
24
19
20
29
28
27
26
25
30
29
32
33
34
35
36
31
32
MbE
MbC
MbD
SuG
FAB
UbA
PaA
DeG
HeG
YcD
CnG
SgG
DuG
SfG
FrG
AaG
CaG
BuG
AbG
CoG
HvG
MyG
MwG
LkG
ChG
HeD
DuC
GaG
BdG
SuD
MbB
CW
ScG
LHG
MwC
HaC
Scale 1:24000
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 36

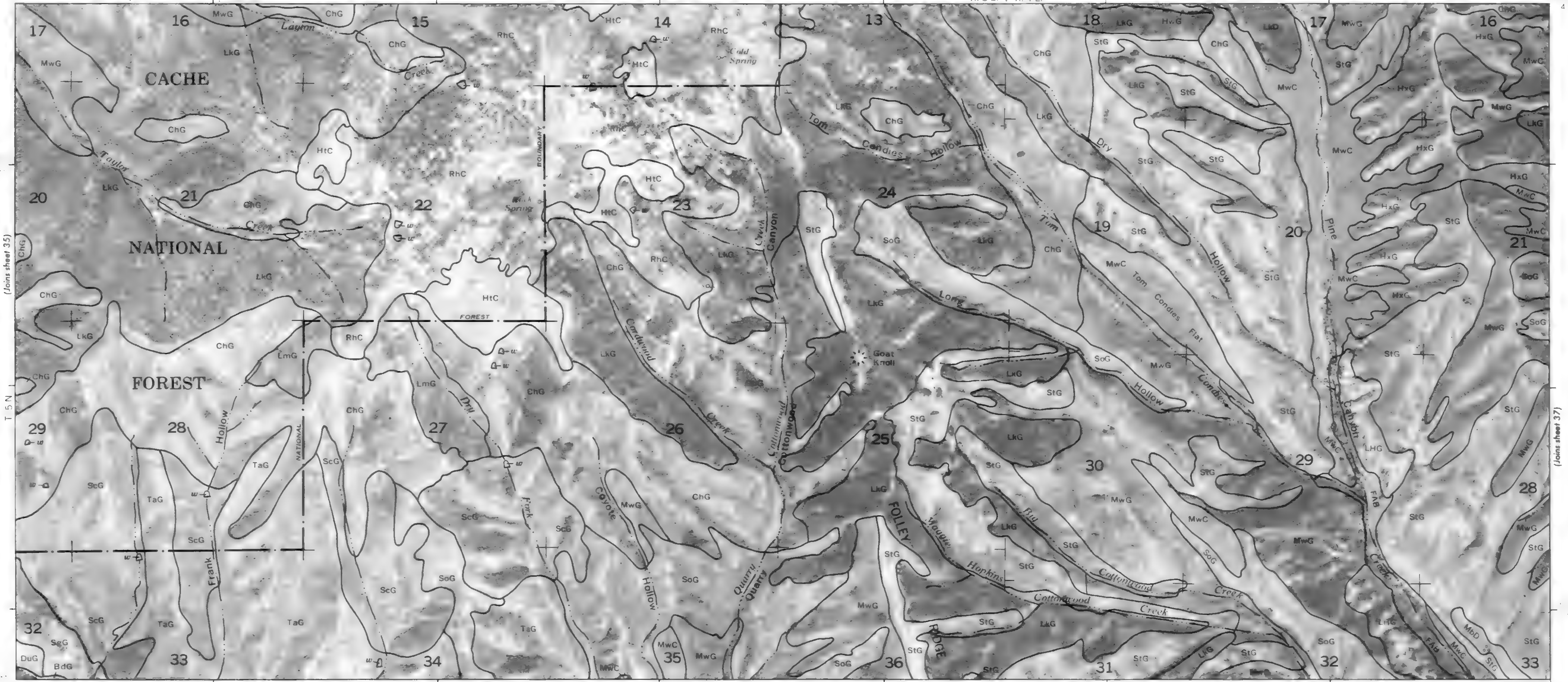
N

(Joins sheet 31)

R. 3 E. | R. 4 E.

(Joins sheet 35)

T. 5 N.



(Joins sheet 37)

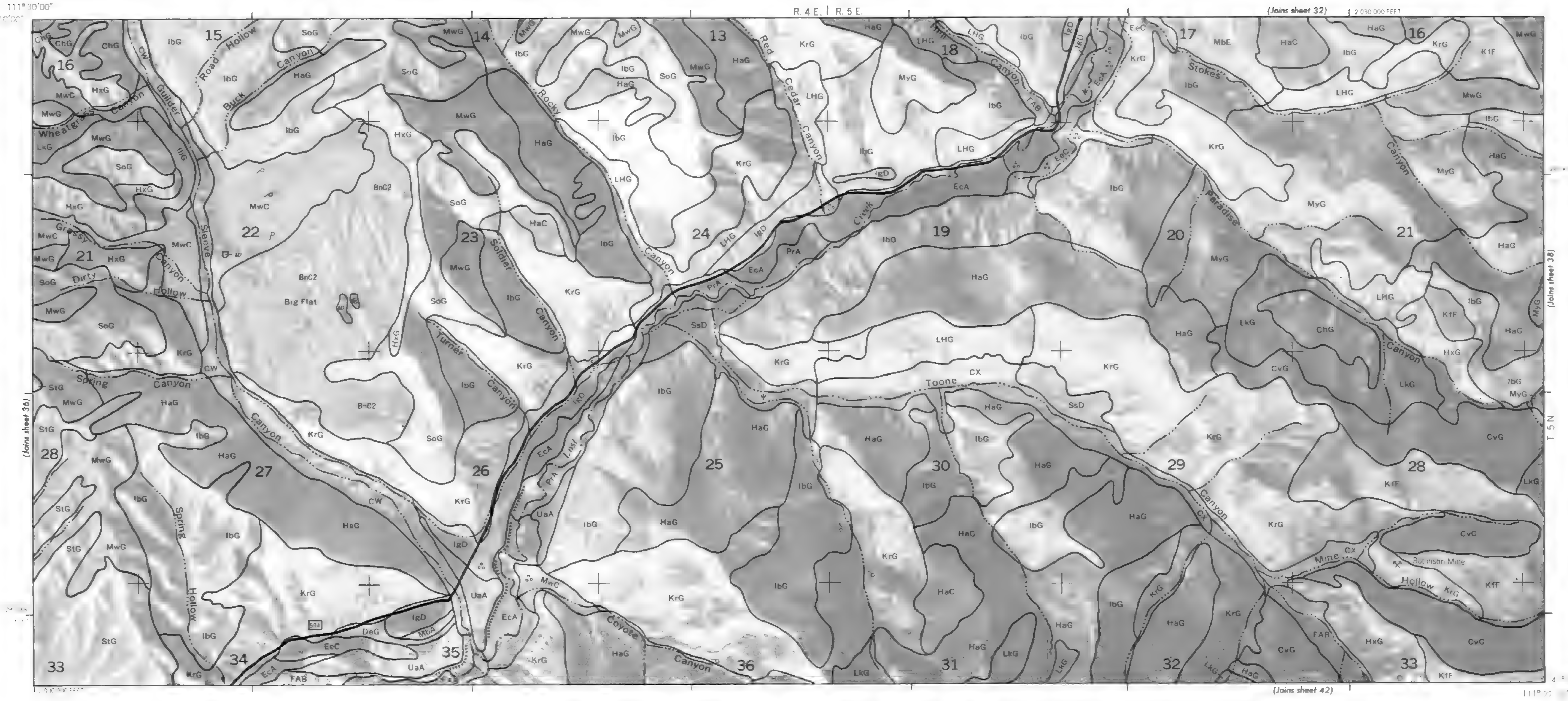
(Joins sheet 41)

Scale 1:24000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

N

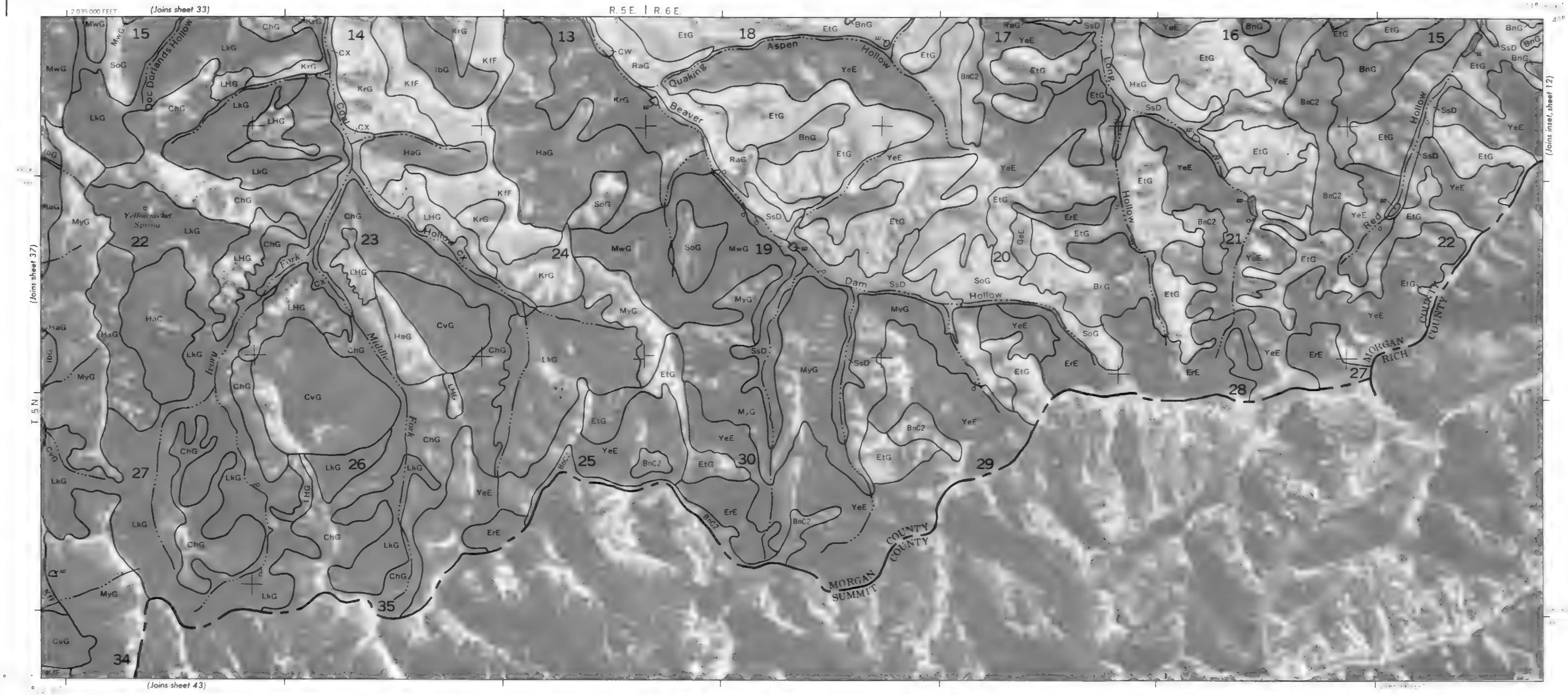


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

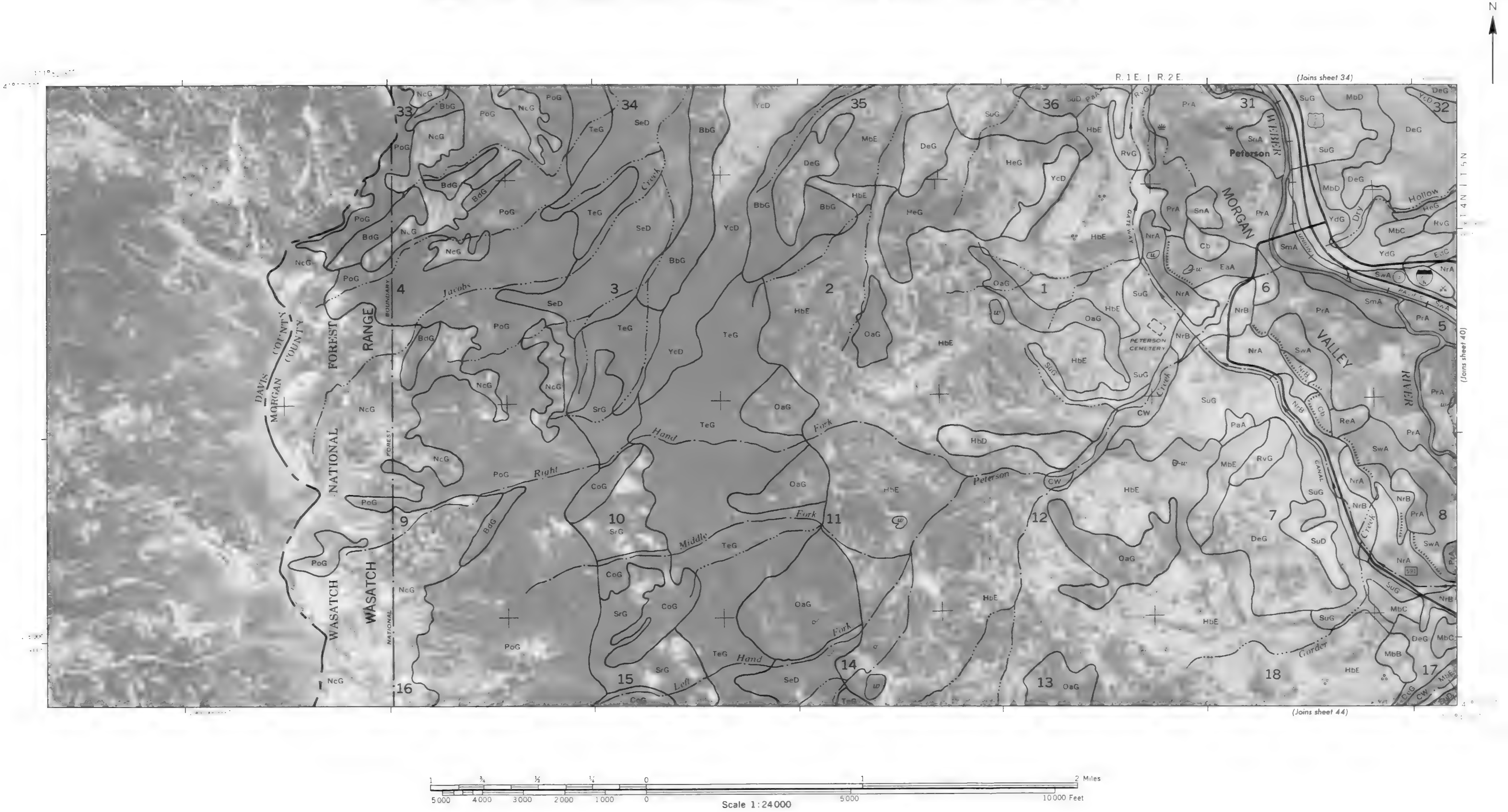
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 38



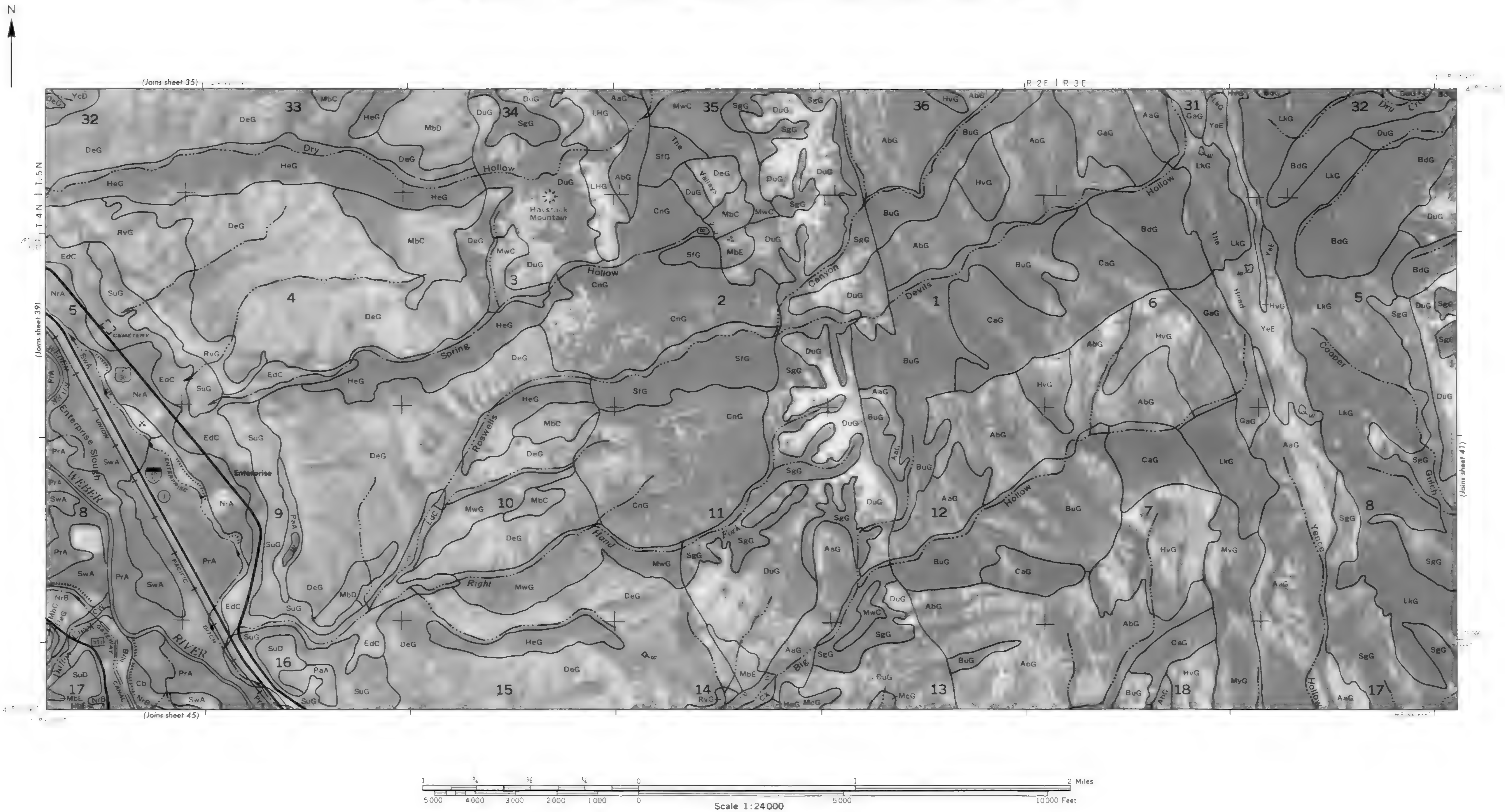
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

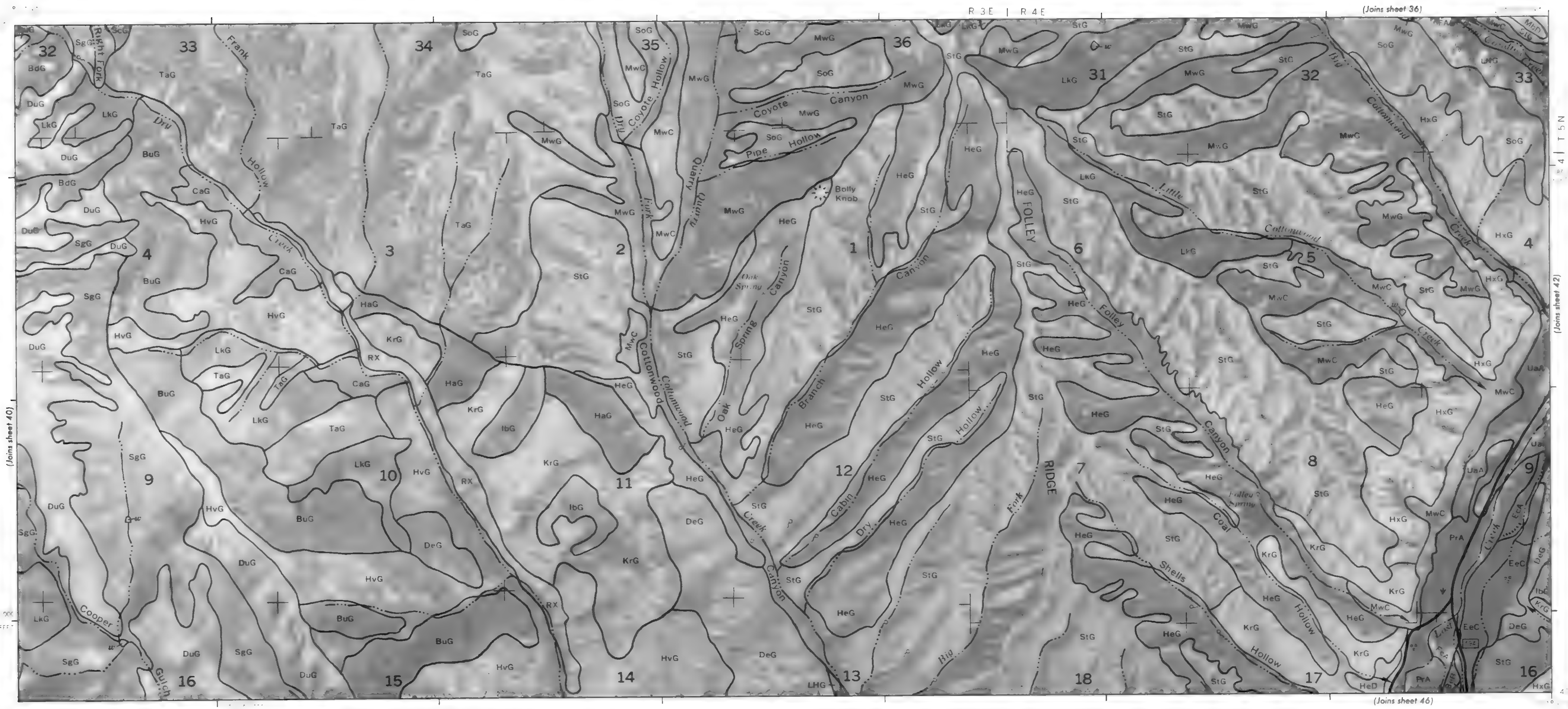

N
R. 1 E. | R. 2 E.
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 44)
T. 4 N. | T. 5 N.
WASATCH NATIONAL FOREST
WASATCH RANGE
DAVIS COUNTY
MORGAN COUNTY
NATIONAL FOREST BOUNDARY
MORGAN VALLEY
WEBER RIVER
Peterson
PETERSON CEMETERY
GATEWAY CANAL
CANAL
Jacobs Creek
Right Hand Fork
Middle Fork
Left Hand Fork
Peterson Creek
Dry Hollow
Gorder
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 40



41

N

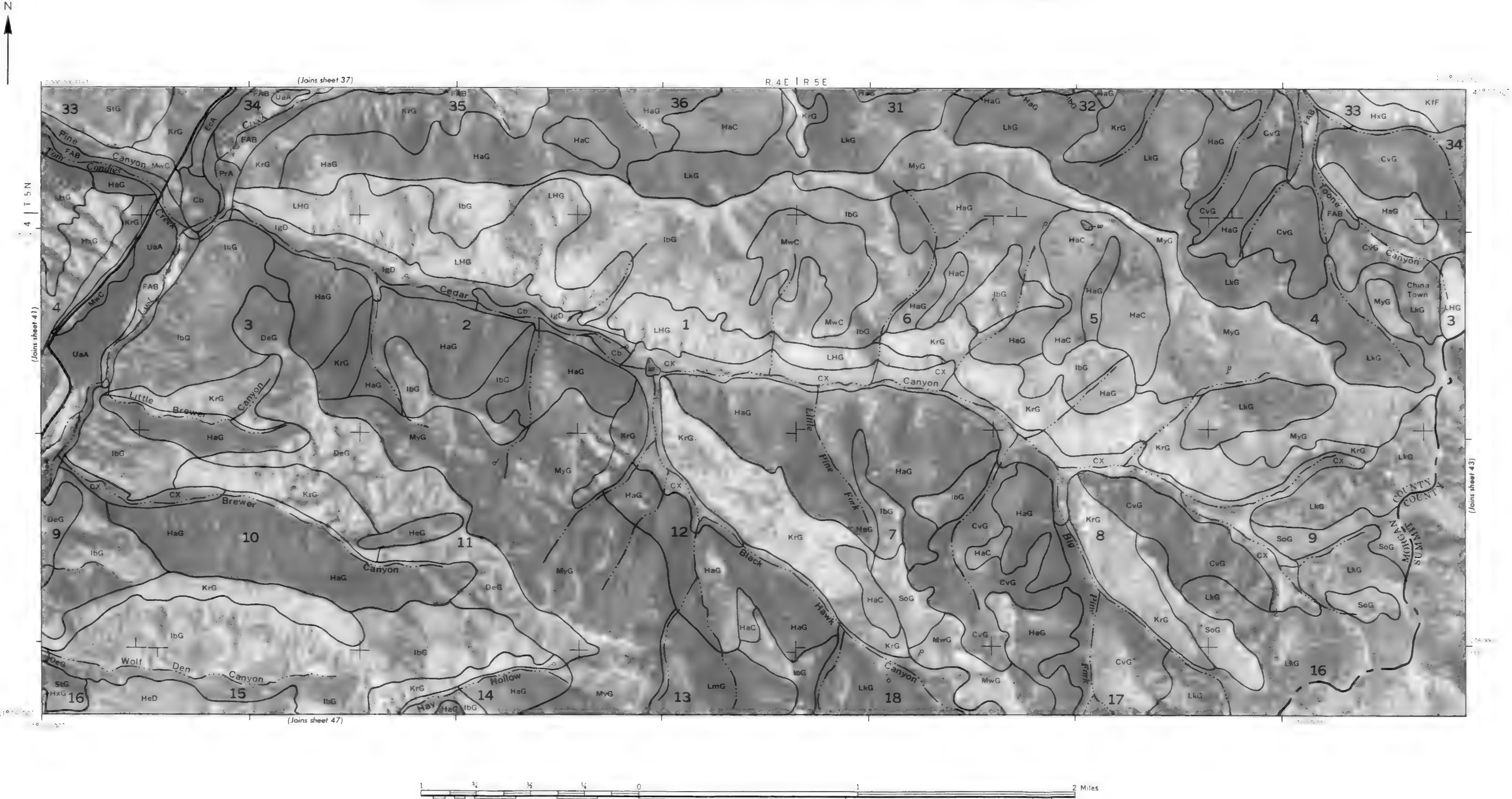


Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

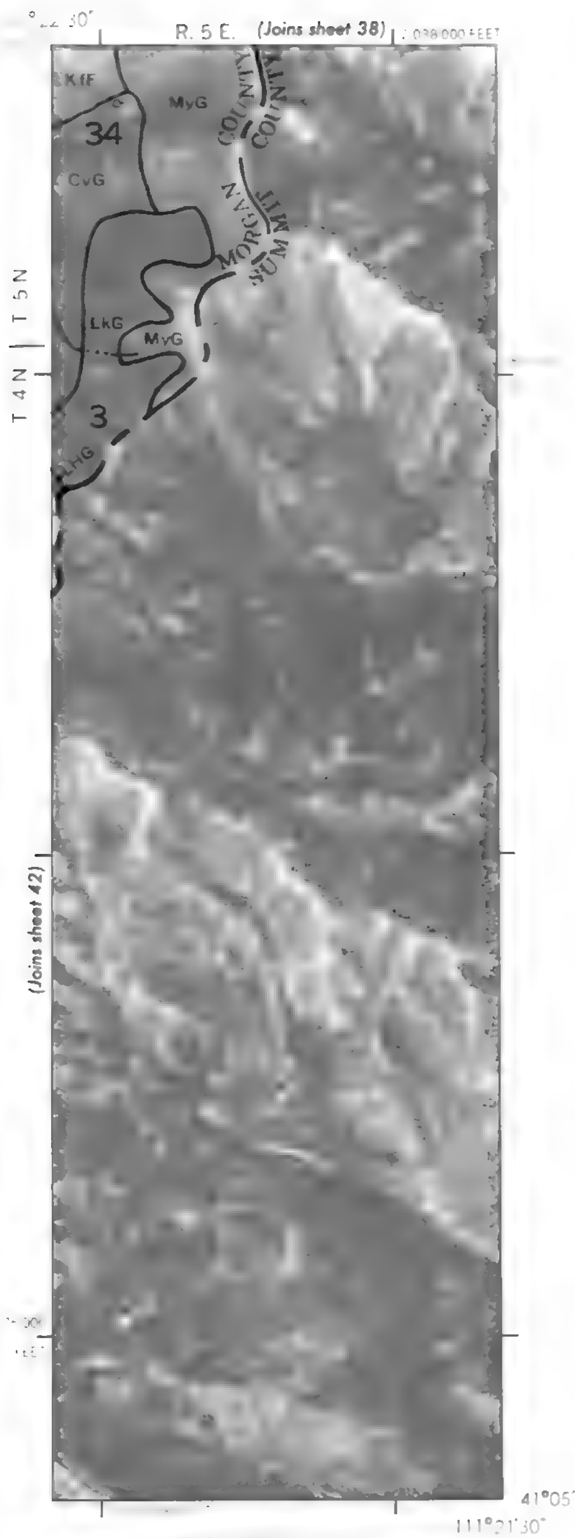
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 42

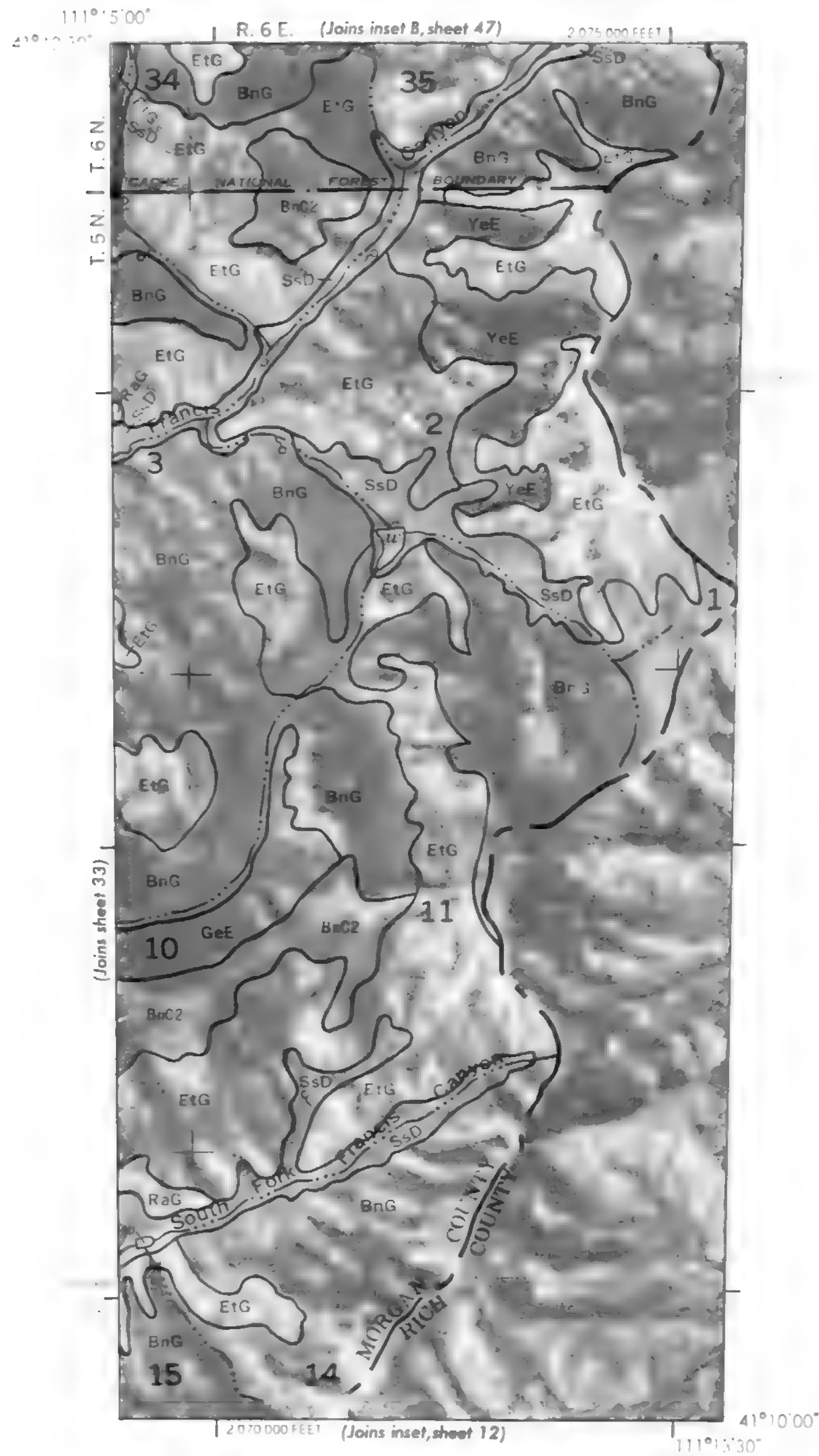


Scale 1:24000

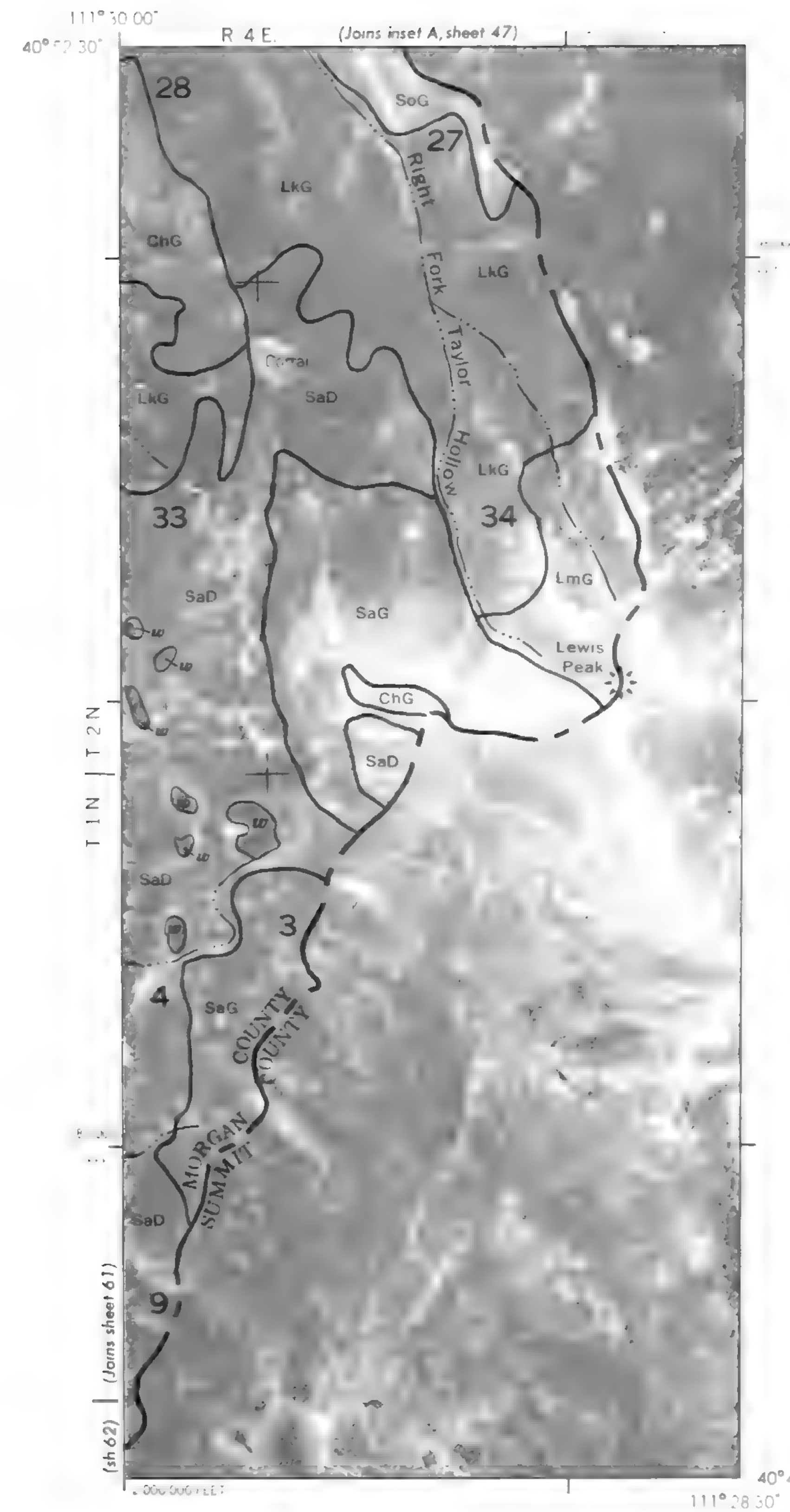
N



INSET A



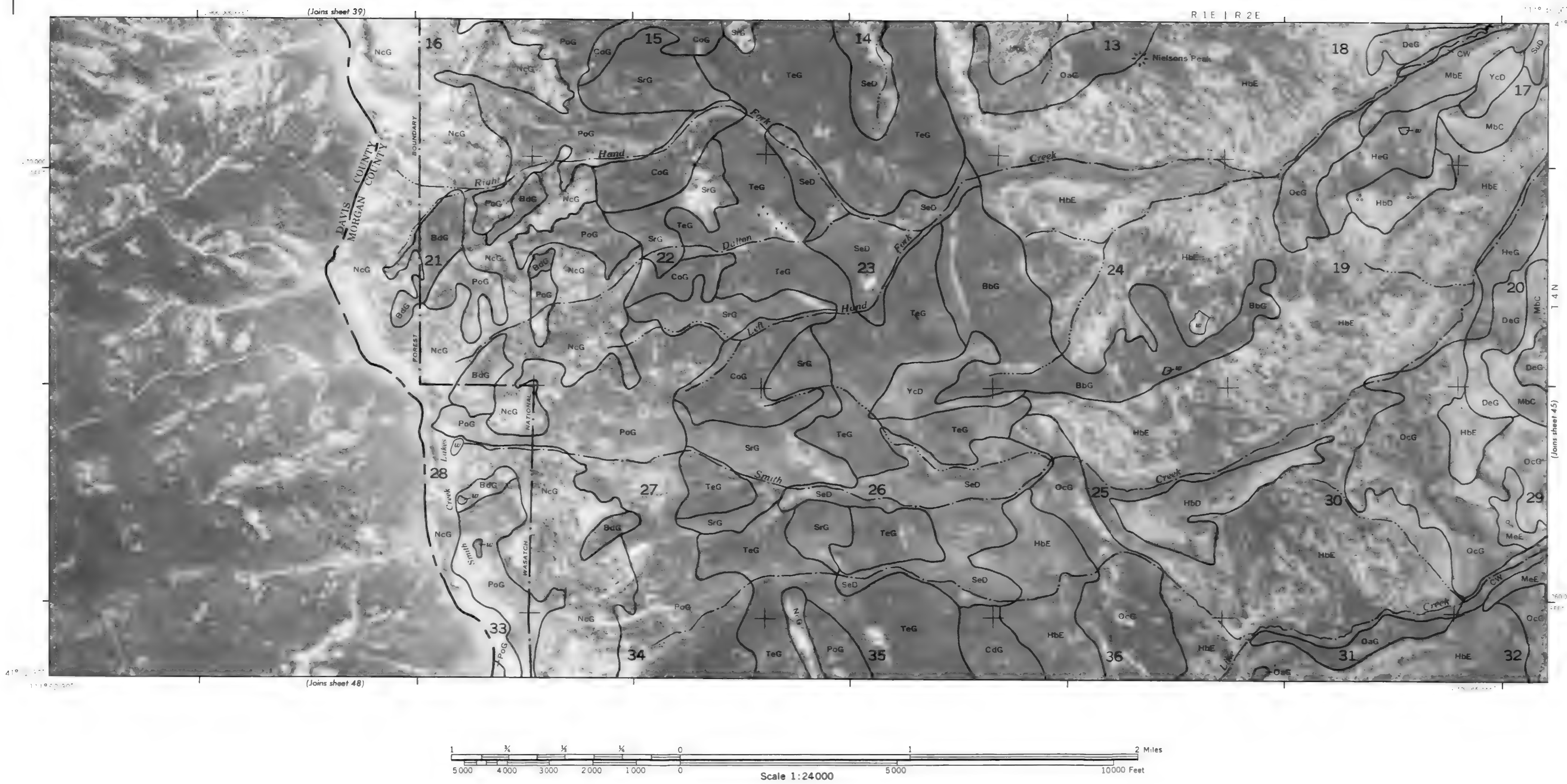
INSET B

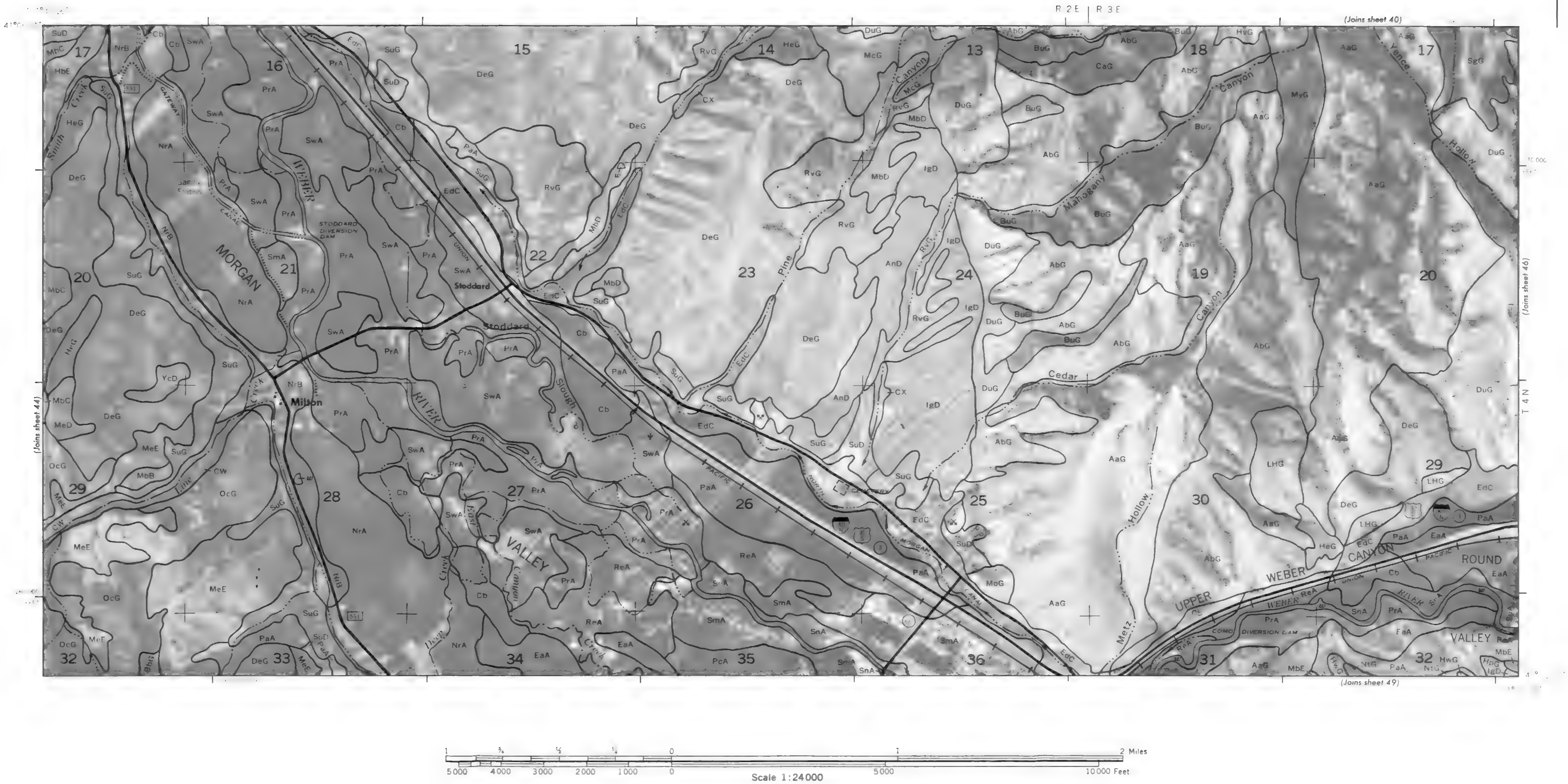


1 ¾ ½ ¼ 0 1 2 Miles

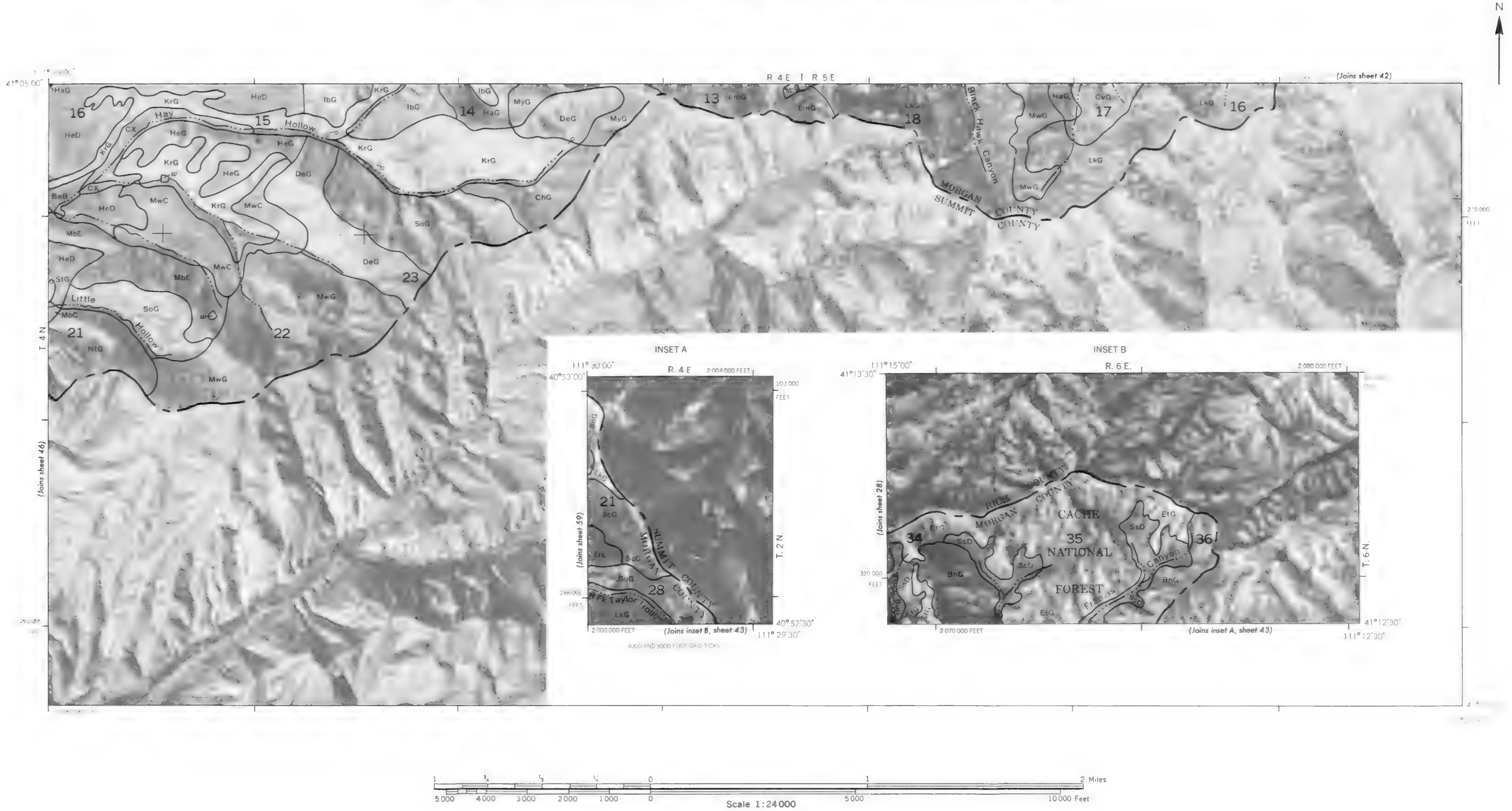
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

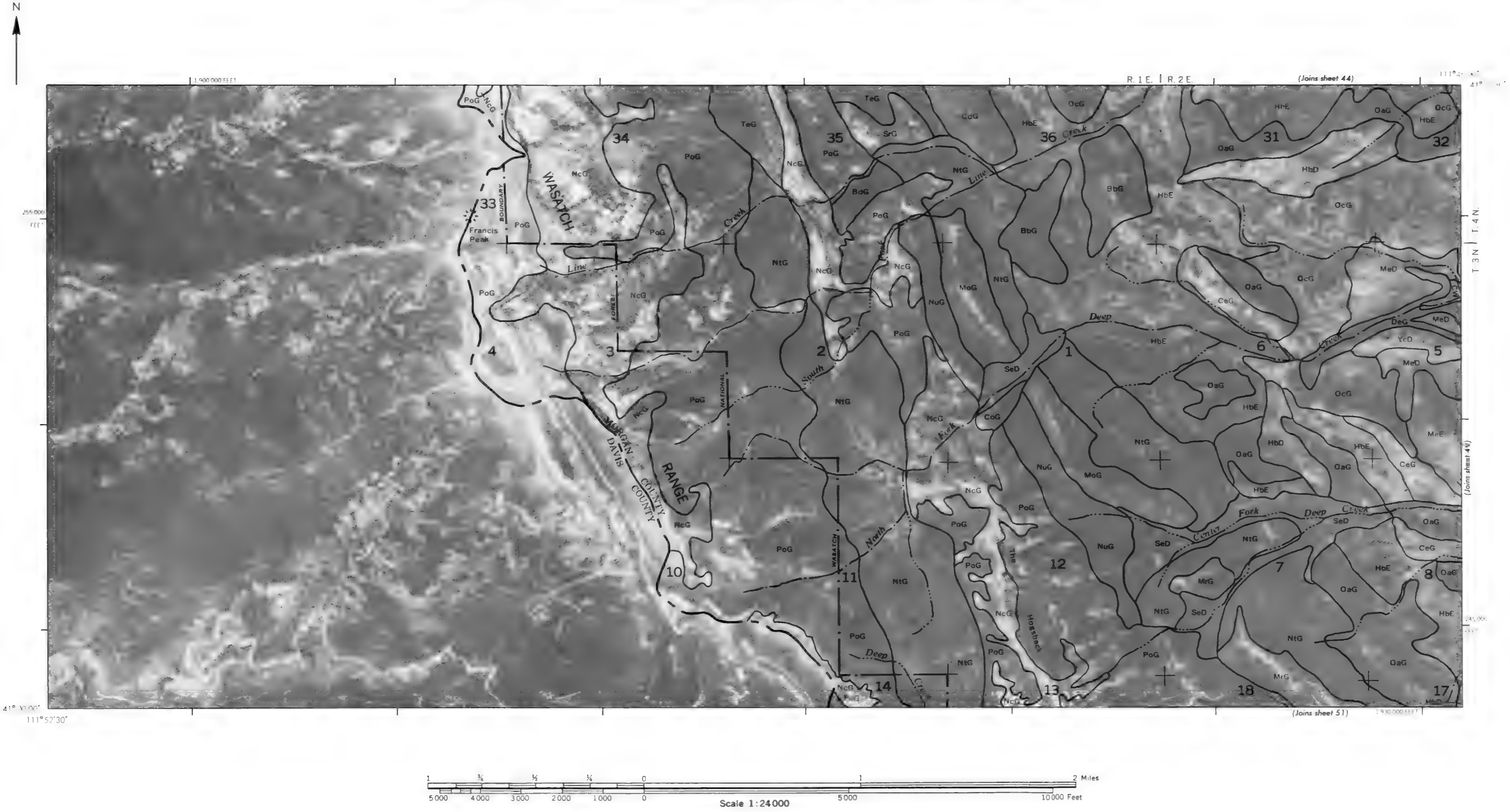

(44)
N
(Joins sheet 39)
R 1 E | R 2 E
16
15
14
13
18
17
Nielsens Peak
DAVIS COUNTY
MORGAN COUNTY
BOUNDARY
FOREST
NATIONAL
WASATCH
Right
Hand
Fork
Creek
Dalton
Left
Hand
Fork
Smith
Creek
Lakes
Creek
Smith
21
22
23
24
19
20
T 4 N
28
27
26
25
30
29
33
34
35
36
31
32
(Joins sheet 45)
(Joins sheet 48)
NcG
PoG
CoG
SrG
TeG
SeD
OaG
HbE
DeG
CW
MbE
YcD
MbC
HeG
HbD
OcG
BdG
BbG
YcD
CdG
MeE
MeE
SuD
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000


N
R 2 E | R 3 E
(Joins sheet 40)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 49)
T 4 N
MORGAN
WEBER
RIVER
Milton
Stoddard
STODDARD DIVERSION DAM
UNION PACIFIC
Smith Creek
GATEWAY CANAL
Line
Slough
East Canyon
Deep Creek
VALLEY
Pine Canyon
Cedar
Mahogany Canyon
Hollow
Metz Hollow
UPPER WEBER CANYON
ROUND VALLEY
COMO DIVERSION DAM
CEMETERY
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 46

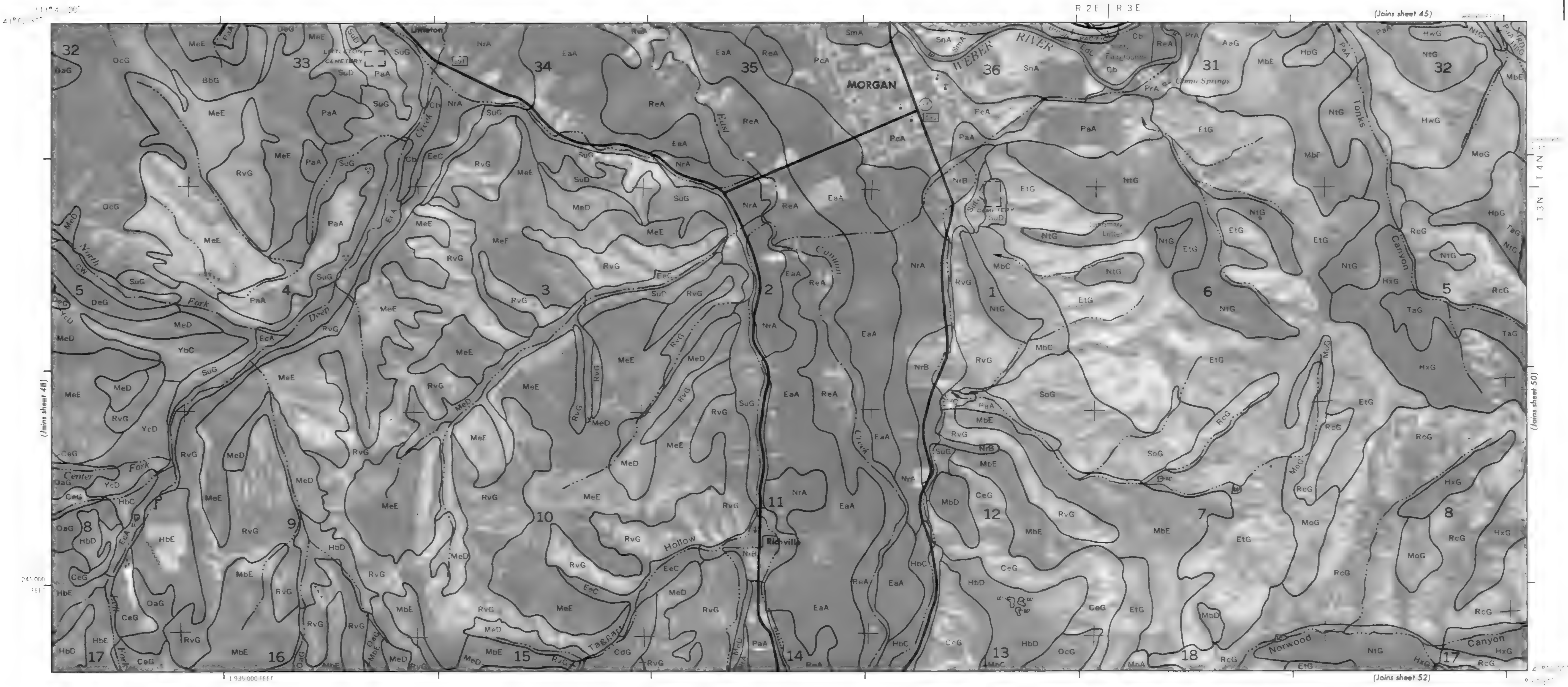

N
R 4 E | R 5 E
(Joins sheet 42)
(Joins sheet 46)
41°05'00"
T 4 N
Hay Hollow
Little Hollow
Black Hawk Canyon
MORGAN COUNTY
SUMMIT COUNTY
13
14
15
16
17
18
21
22
23
HxG
HeD
KrG
IbG
CX
HeG
DeG
MyG
HaG
LmG
LkG
MwG
CvG
BeB
MwC
MbE
StG
SoG
MbC
NtG
ChG
INSET A
111°30'00"
R. 4 E.
2 004 000 FEET
40°53'00"
203 000 FEET
(Joins sheet 59)
T. 2 N.
SUMMIT COUNTY
MORGAN COUNTY
ScG
ErE
Taylor Hollow
28
2 000 000 FEET
(Joins inset B, sheet 43)
40°52'30"
111°29'30"
4000 AND 5000 FOOT GRID TICKS
INSET B
111°15'00"
R. 6 E.
2 080 000 FEET
41°13'30"
(Joins sheet 28)
RICH COUNTY
MORGAN COUNTY
CACHE NATIONAL FOREST
34
35
36
SsD
EtG
BnG
Canyon
320 000 FEET
T. 6 N.
2 070 000 FEET
(Joins inset A, sheet 43)
41°12'30"
111°12'30"
1
2 Miles
5000
4000
3000
2000
1000
0
10000 Feet
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 48



49

N

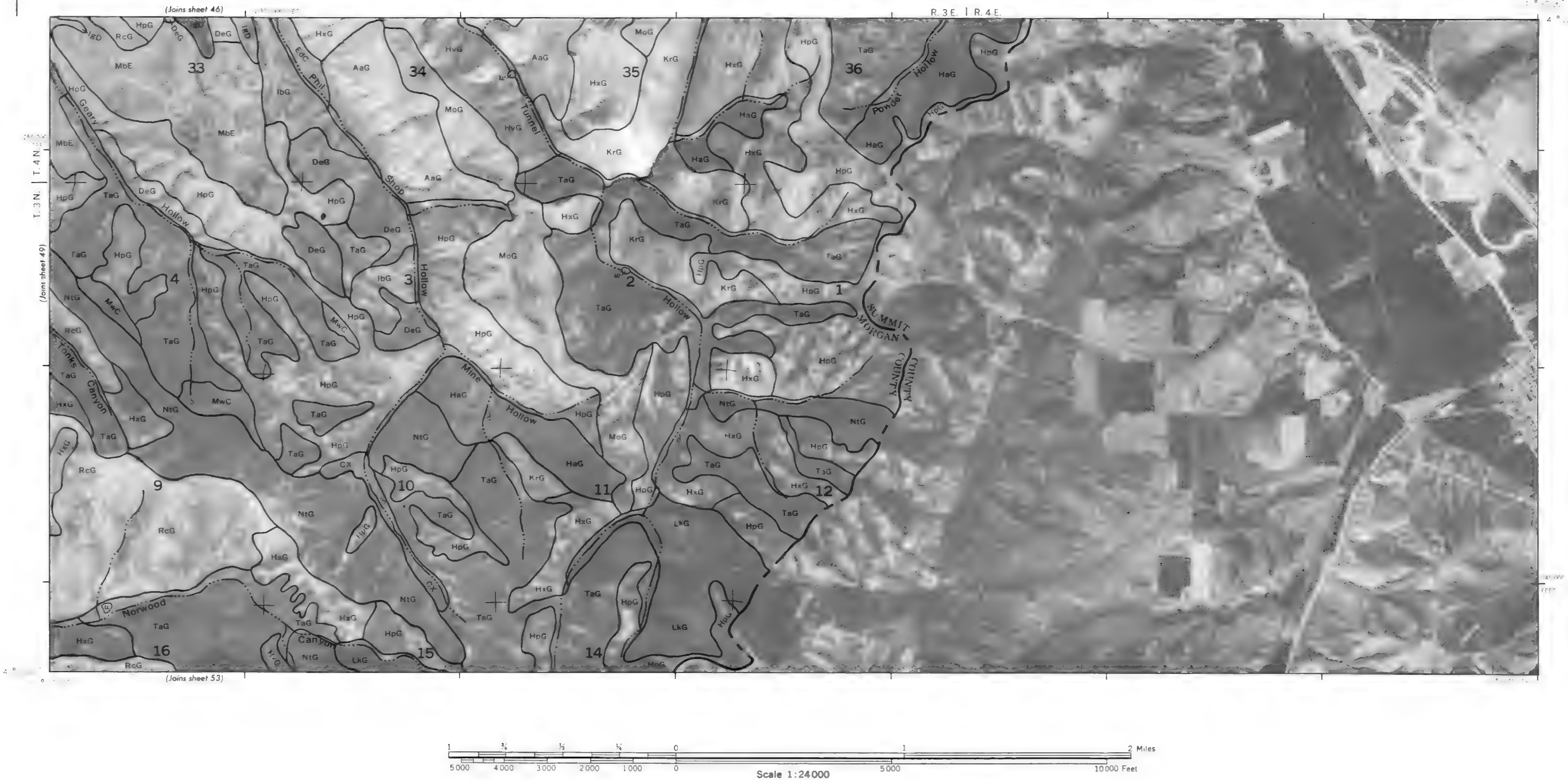


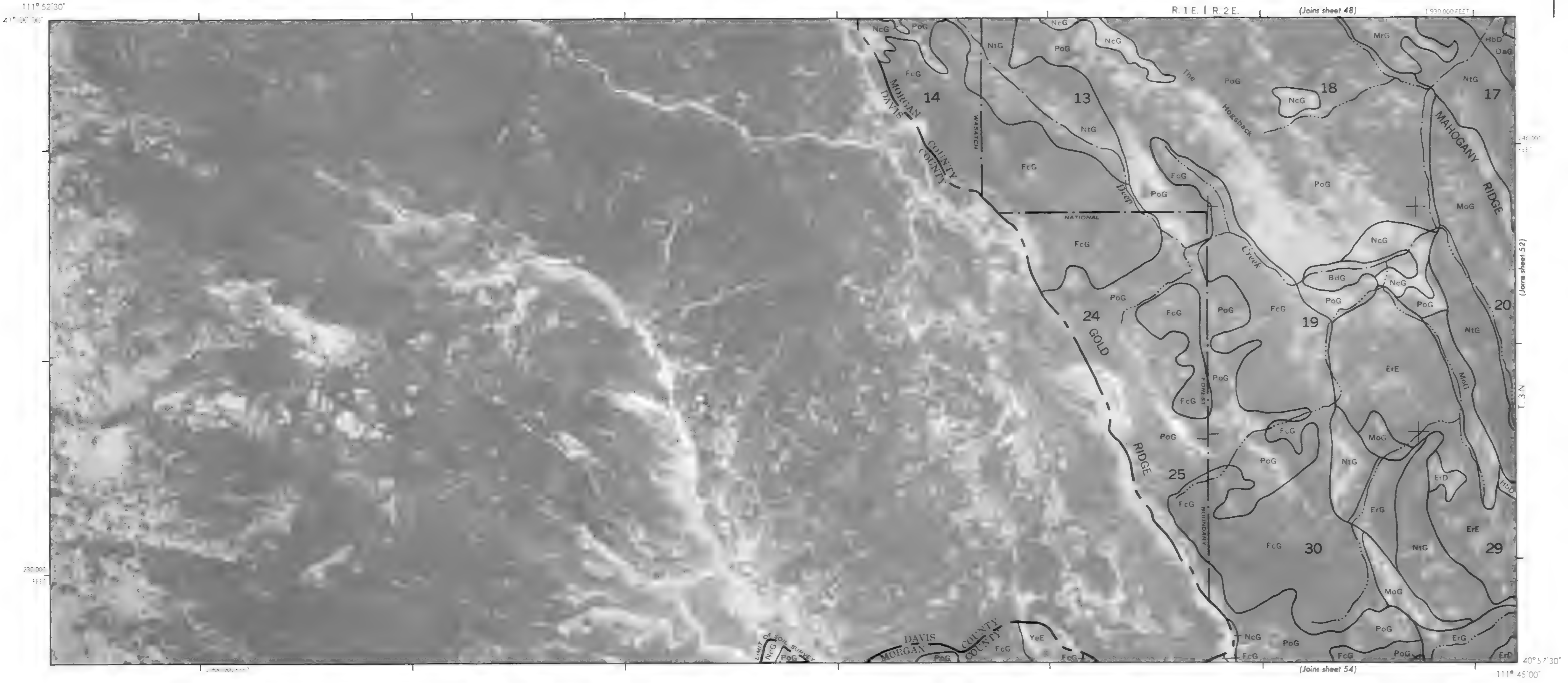
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

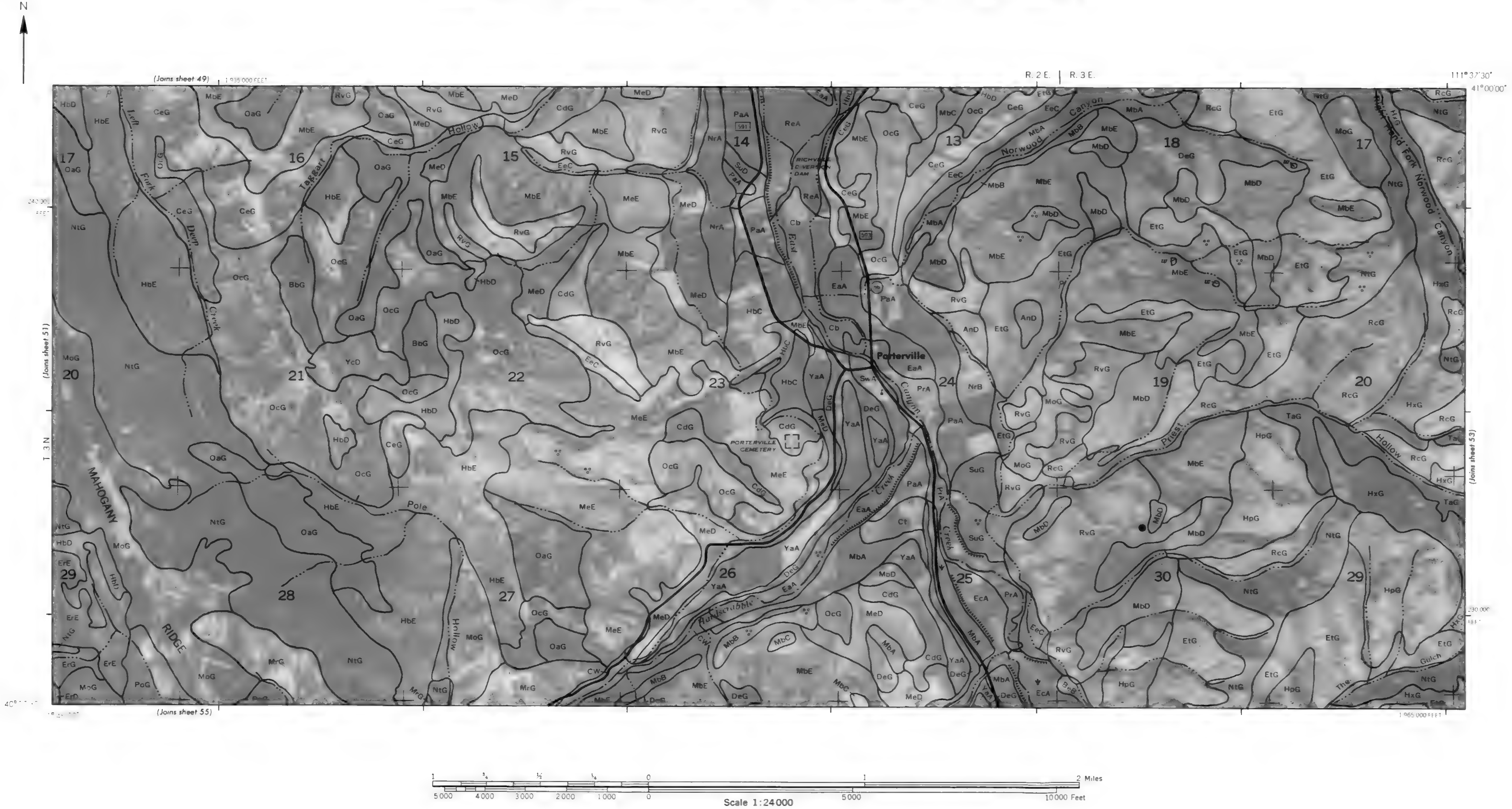
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 50

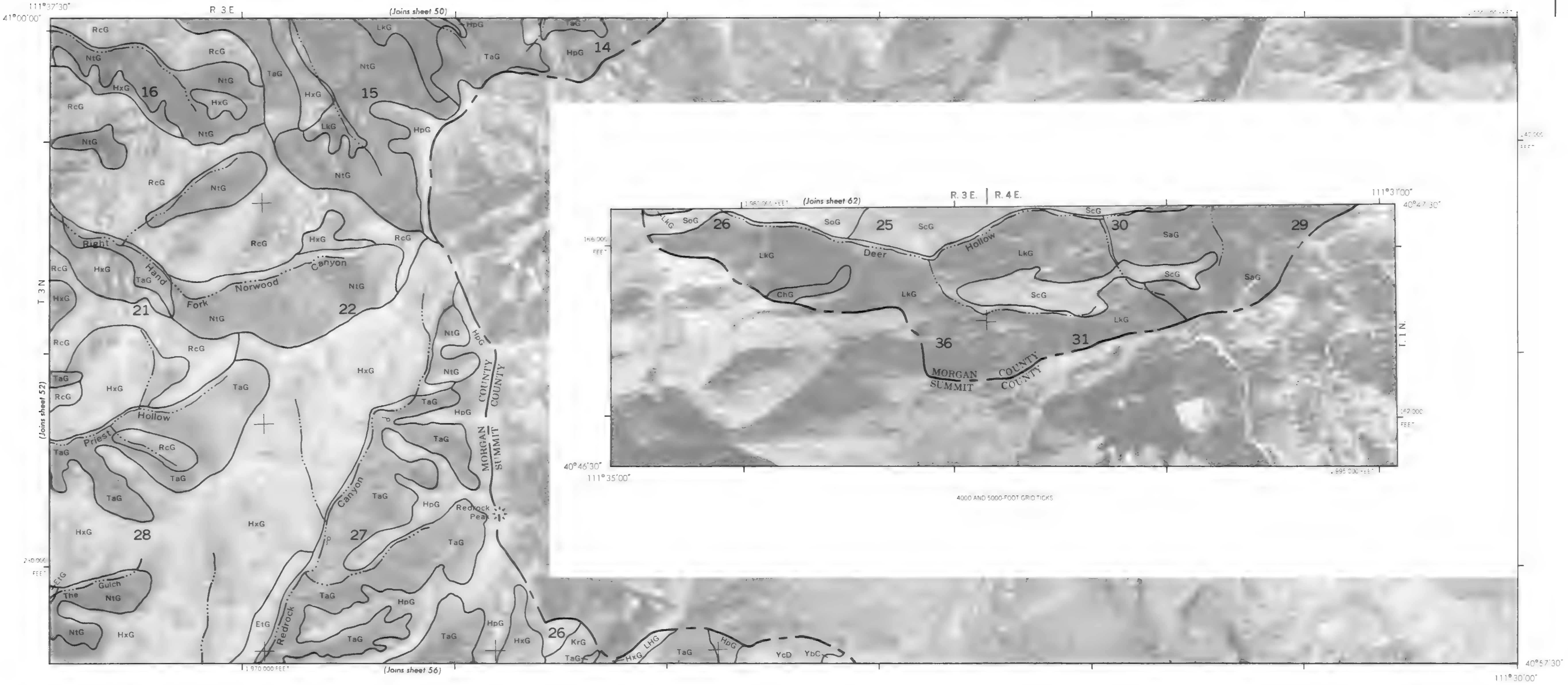




1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 52



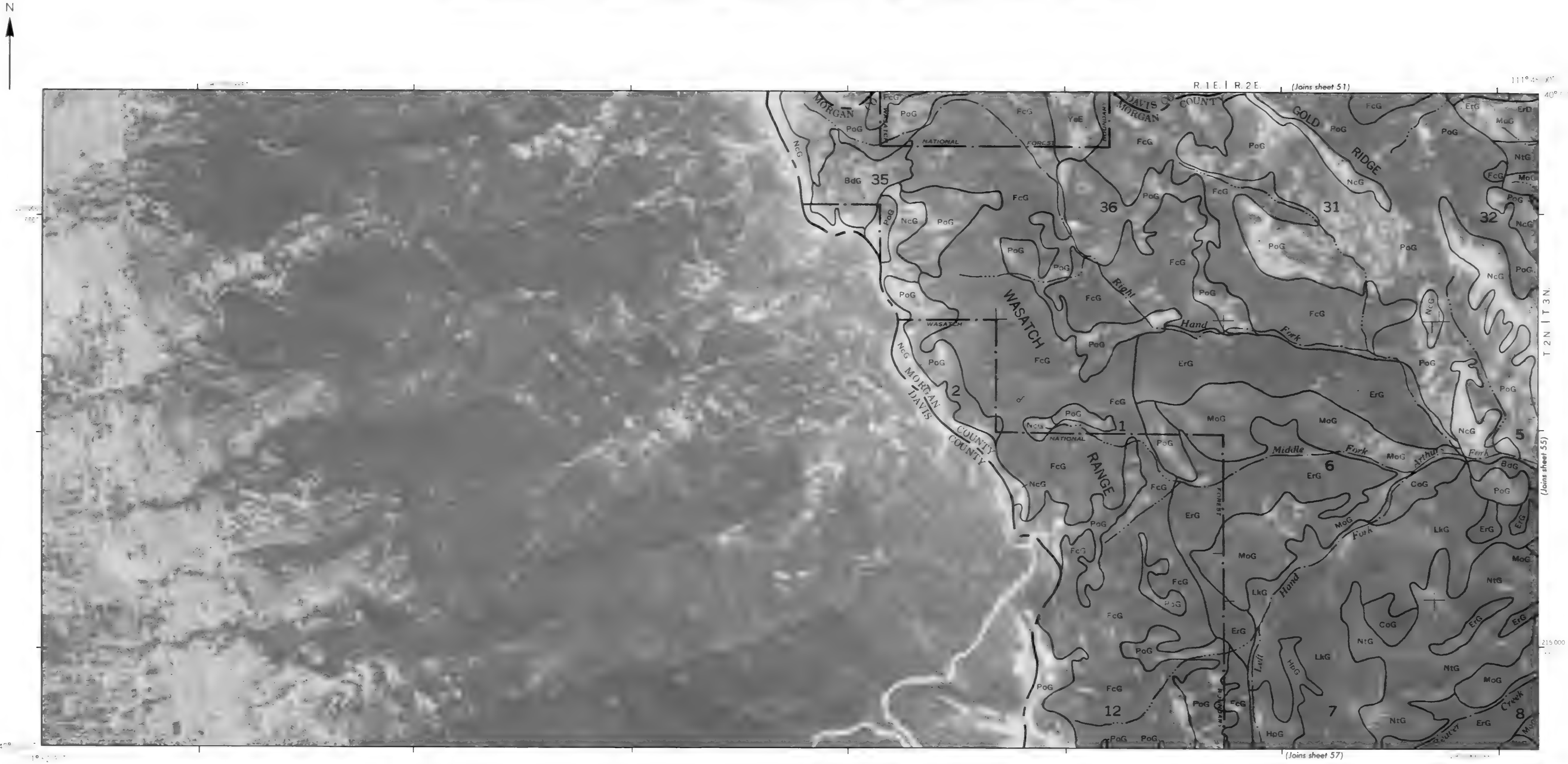


1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

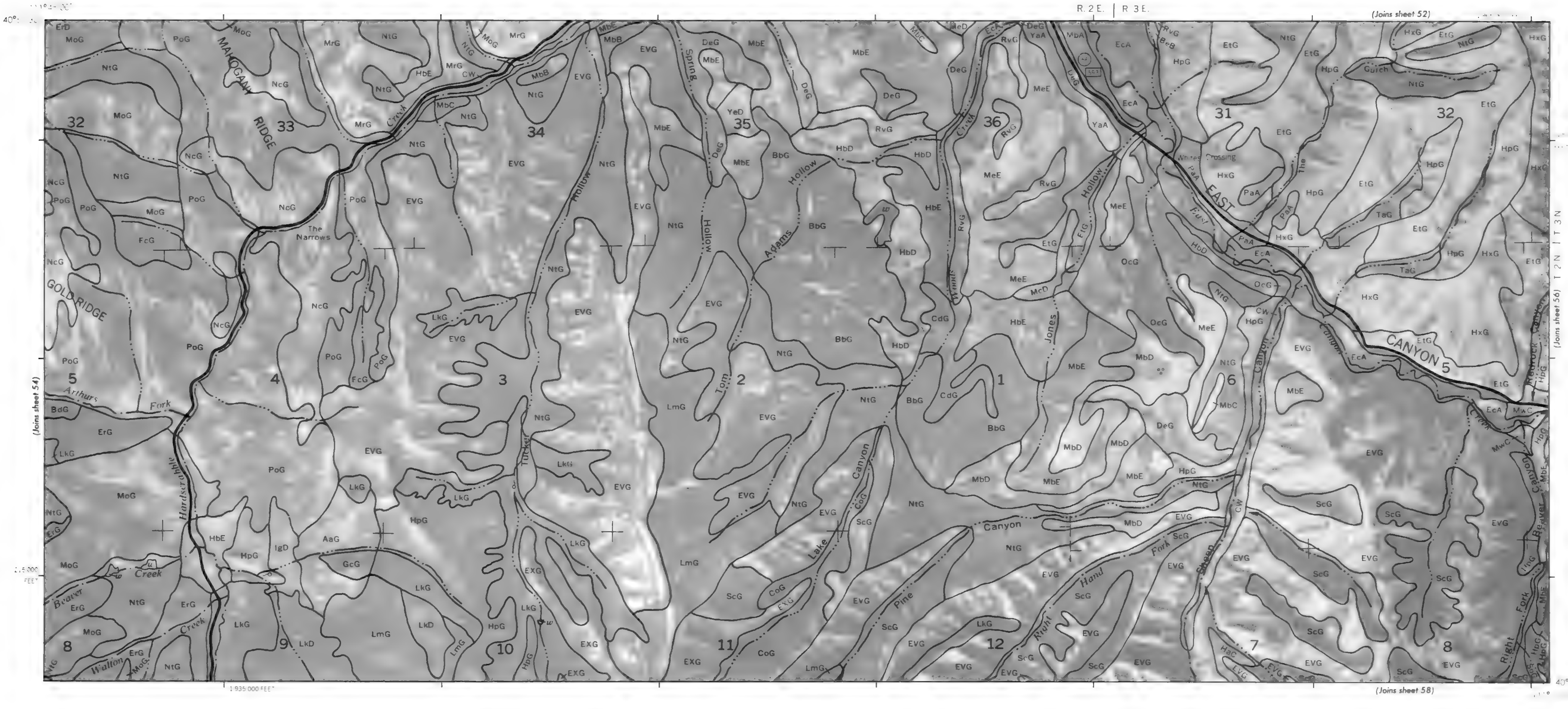
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 54



Scale 1:24 000

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

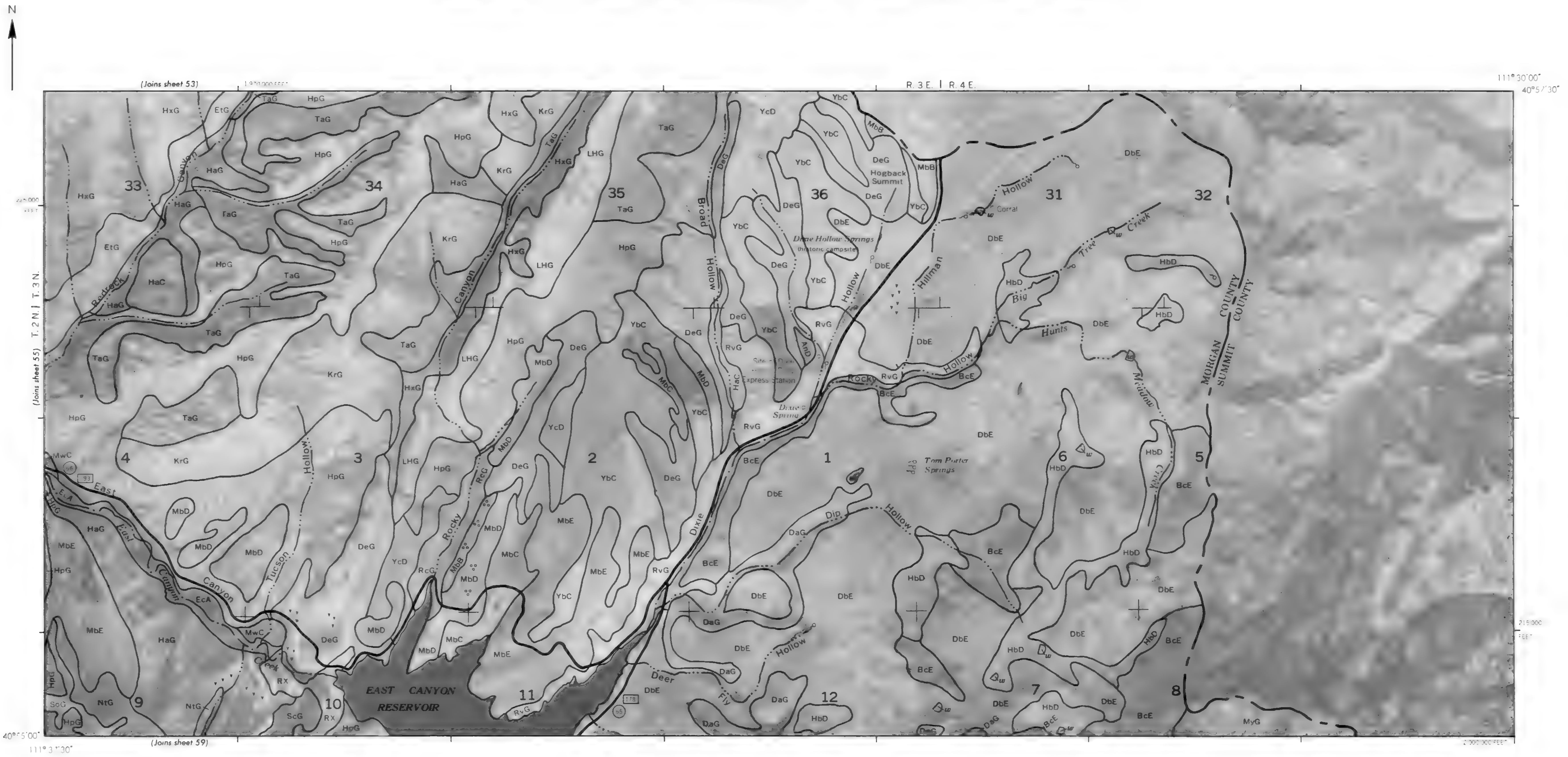


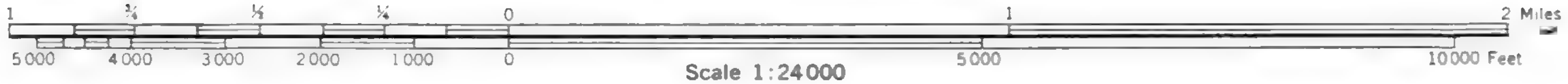
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10 000 Feet

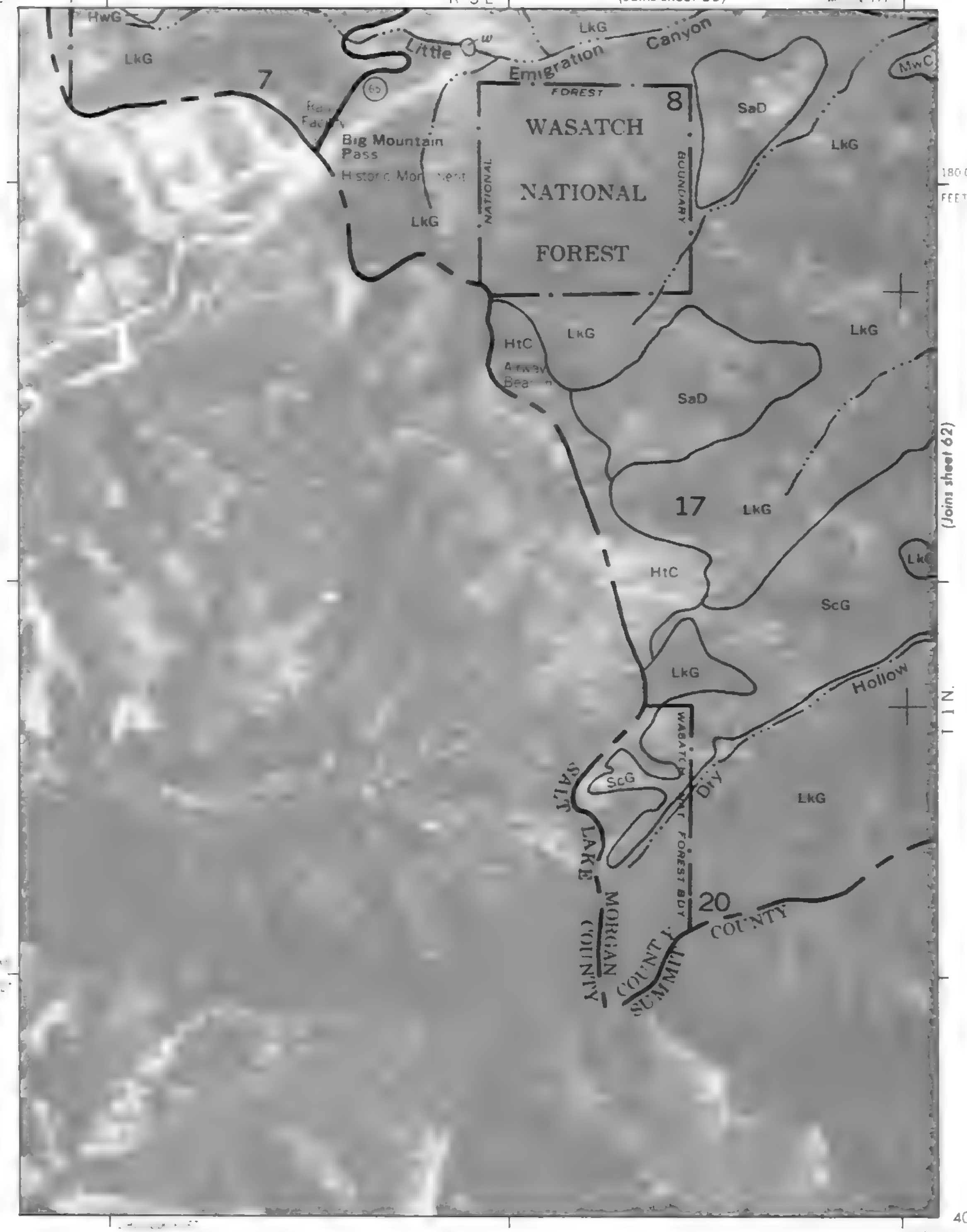
Scale 1:24000

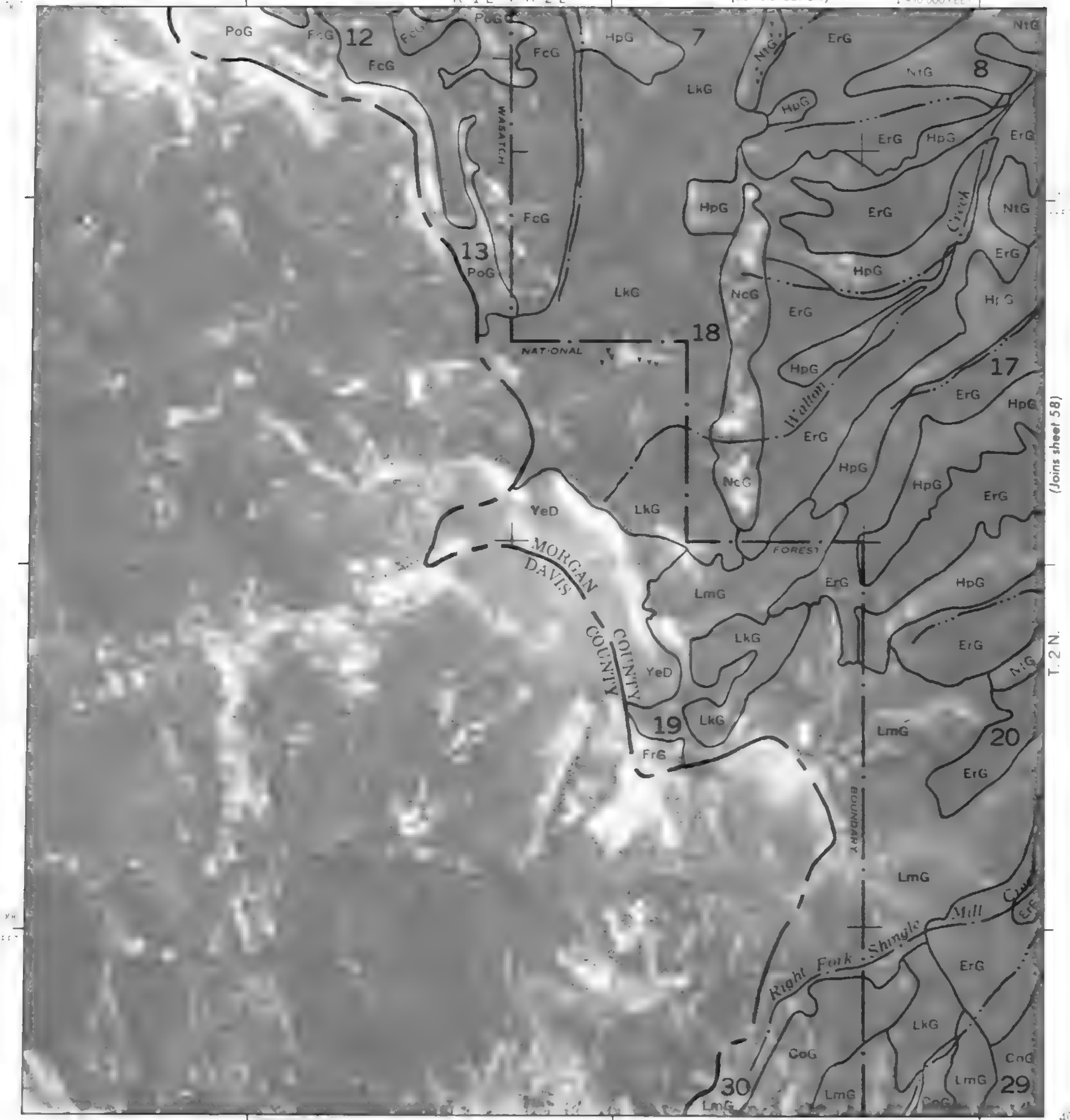
MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 56





Scale 1:24000





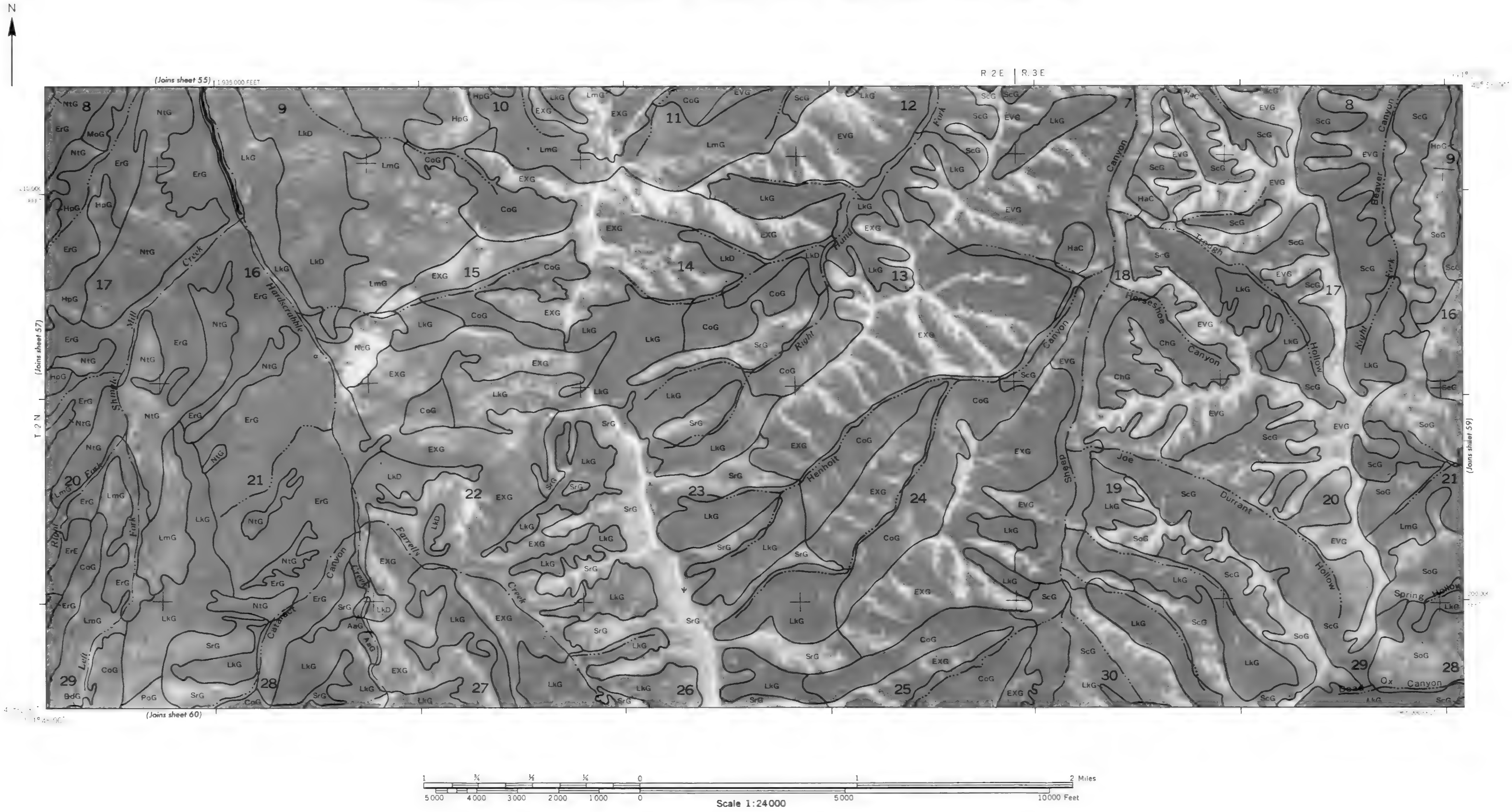
Scale 1:24000

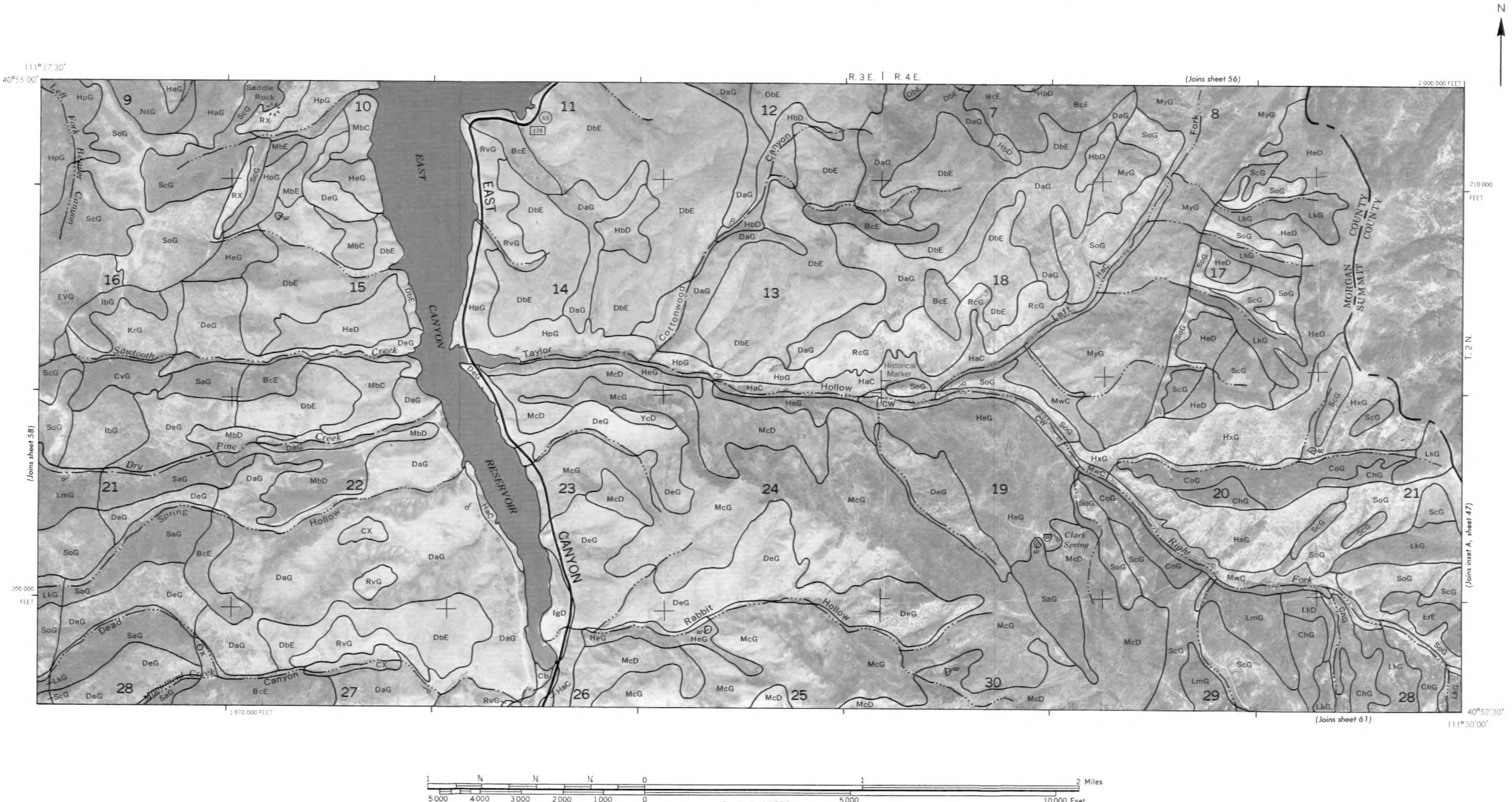
1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

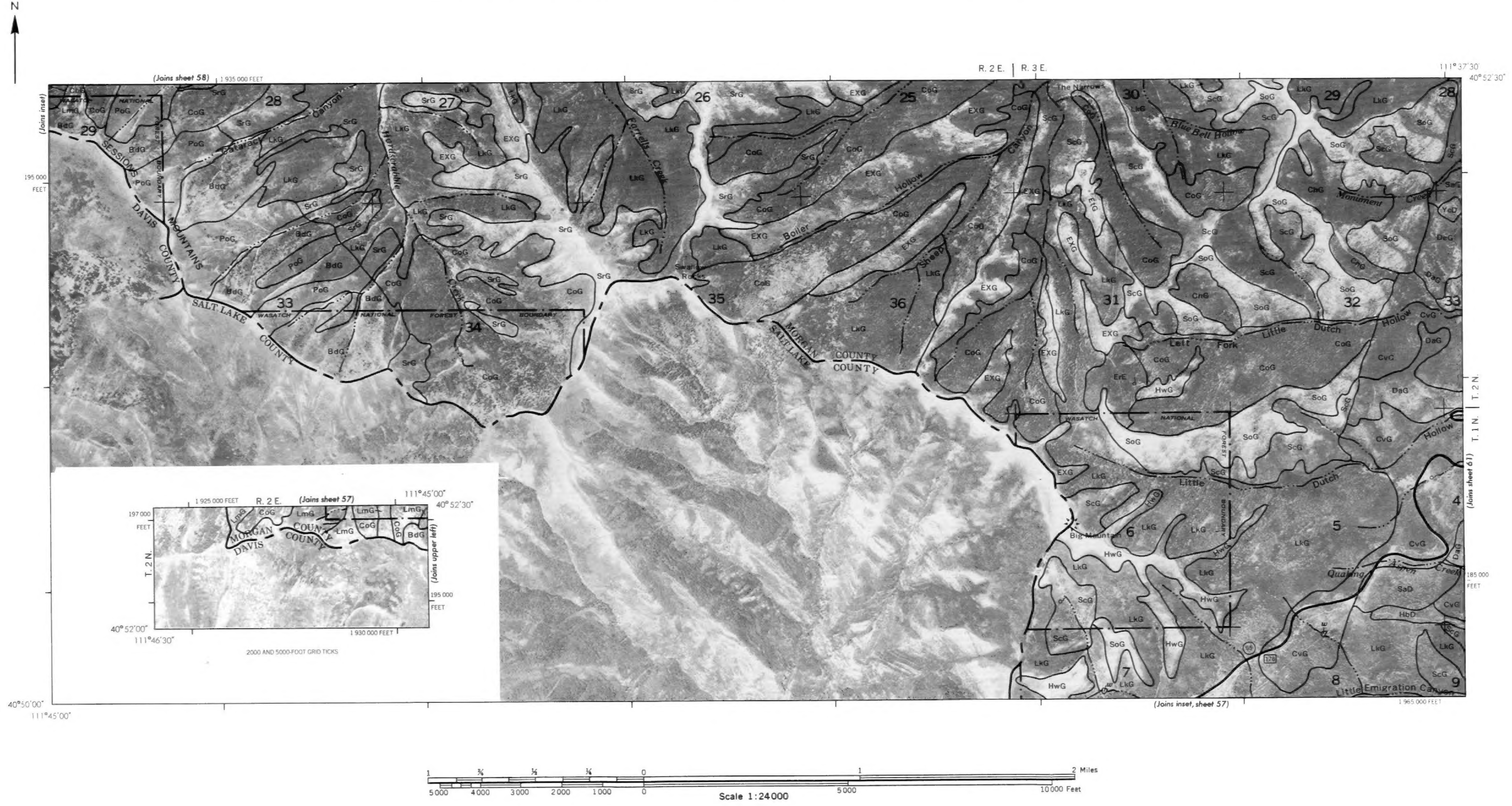
58

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 58





Scale 1:24 000


N
R. 2 E.
R. 3 E.
111°37'30"
40°52'30"
(Joins sheet 58)
1 935 000 FEET
(Joins inset)
195 000 FEET
SESSIONS MOUNTAINS
DAVIS COUNTY
SALT LAKE COUNTY
MORGAN COUNTY
SALT LAKE COUNTY
WASATCH NATIONAL FOREST BOUNDARY
Cataract Canyon
Hardscrabble Creek
Farrells Creek
Boiler Hollow
Sheep
Canyon
The Narrows
Blue Bell Hollow
Monument Creek
Swallow Rocks
Left Fork Little Dutch Hollow
Little Dutch
Big Mountain
Quaking Aspen Creek
Little Emigration Canyon
T. 2 N.
T. 1 N.
(Joins sheet 61)
185 000 FEET
(Joins inset, sheet 57)
1 965 000 FEET
40°50'00"
111°45'00"
1 925 000 FEET
R. 2 E.
(Joins sheet 57)
111°45'00"
40°52'30"
197 000 FEET
MORGAN COUNTY
DAVIS COUNTY
(Joins upper left)
195 000 FEET
40°52'00"
111°46'30"
1 930 000 FEET
2000 AND 5000-FOOT GRID TICKS
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

61

N

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

Scale 1:24 000

MORGAN AREA, UTAH, MORGAN COUNTY AND EASTERN PART OF WEBER COUNTY — SHEET NUMBER 62

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000